User Manual

BL70W – Box PC for Wireless Applications (Intel®)

BL70W - Box PC for Wireless Applications (Intel®)

The BL70W is a fanless, maintenance-free box computer that has been designed for independent use or as display computer electronics for wireless applications in transportation, e.g. in trains, commercial vehicles, mobile machines or airplanes.

Four PCI Express® Mini Card slots each with dual SIM make it possible to flexibly implement the whole range of wireless interfaces such as mobile service standards GSM (2G), UMTS (3G), LTE (4G) and derivates and wireless communication standards WLAN / Wi-Fi IEEE 802.11 and derivates. A GNSS interface supporting positioning systems GPS and GLONASS complements the possibilities.

The BL70W is powered by an Intel® Core™ i7-3517UE CPU, running at 1.7 GHz. Other processors of the 3rd generation Intel® Core™ i7 family can be used which makes for high scalability in CPU (single/dual/quad core) performance.

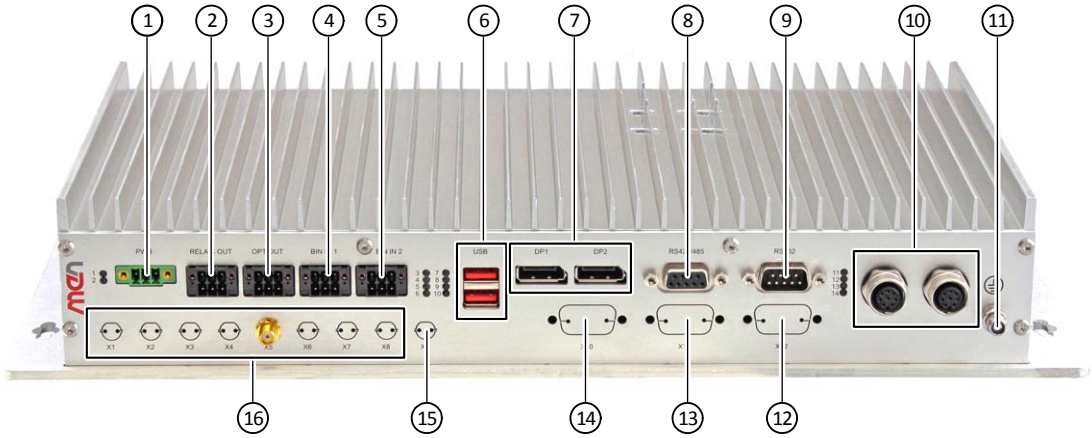
The BL70W is equipped with 4 GB of DDR3 SDRAM and offers microSD™ card and mSATA slots. A SATA hard-disk/solid-state drive can be installed within the housing as an option. The system is designed for fanless operation at temperatures from -40 to +70°C (+85°C for up to 10 minutes), its special aluminum housing with cooling fins serves as a heatsink for the internal electronics and in this way provides conduction cooling.

The BL70W supports up to two DisplayPort® interfaces with full HD resolution. In addition, a multitude of other I/O is available at the front panel, including two Gigabit Ethernet, two USB 2.0, variable slots for legacy serial I/O (e.g. RS232) or CAN bus, general purpose inputs and relay outputs.

The BL70W comes with its own integrated 30W 24 VDC nom. (10 to 50.4 V) class S2 wide-range power supply and is in compliance with EN 50155 and ISO 7637-2 (E-mark for automotive). The power can be switched on and off using an ignition signal on the power connector, and a run-down time after switching off the power can be adjusted by software.

The various CPU options with the available selection of external interfaces (realized via separate graphics and I/O interface boards within the system) makes for an extremely flexible system design that can quickly be tailored to a vast number of applications.

Diagram



1. PSU (10V-50.4V)
2. 2 relay outputs
3. 2 photocoupler outputs
4. 6 binary inputs
5. 1 odometer input, 1 IBIS slave, 1 binary input
6. 2 USB 2.0 interfaces
7. 2 DisplayPorts
8. RS422/485 interface
9. RS232 interface
10. 2 Gigabit Ethernet on M12 connectors
11. Earthing stud
12. SA-Adapter connector for RS232, RS422/485 or IBIS
13. SA-Adapter connector for RS232, RS422/485 or IBIS
14. SA-Adapter connector for RS232, RS422/485, IBIS or CAN
15. Antenna connector for GNSS
16. Antenna connectors for PCI Express Mini Cards

Technical Data

CPU

- Intel® Core™ i7-3517UE
  - 1.7 GHz processor core frequency
  - 2.8 GHz maximum turbo frequency
- Chipset
  - QM77 Platform Controller Hub (PCH)

Memory

- 4 MB last level cache integrated in i7 processor
- 4 GB SDRAM system memory
  - Soldered
  - DDR3 with ECC support
  - Up to 1066 MHz memory bus frequency

Mass Storage

- One microSD™ card slot
  - Via USB 2.0
- One mSATA slot
  - SATA Revision 2.x support
  - Transfer rates up to 300 MB/s (3 Gbit/s)
- Serial ATA (SATA)
  - One port for 2.5" hard-disk/solid-state drive mounted within the unit's housing
  - SATA Revision 2.x support
  - Transfer rates up to 300 MB/s (3 Gbit/s)

Graphics

- Integrated in processor and chipset
- Maximum resolution: 2560 x 1600 pixels
- Via two DisplayPort® interfaces

Front I/O

- 2 DisplayPort® 1.1a interfaces
  - AUX channels and hot plug detection
- 2 Gigabit Ethernet
  - Via M12 connectors
  - Electrically isolated
- 2 USB 2.0
  - Via Series A connector
- 7 general purpose inputs
  - Input voltage range from 0 V up to 154 V independent of the power supply input voltage
  - Input signal frequency max. 10 Hz

- 2 relay outputs
  - Max. switching current 0..30 V: 2 A
  - Max. switching current 30..72 V: 0.9 A
  - Max. switching current 72..154 V: 0.3 A
  - Max. switching voltage: 154 V
  - Max. switching frequency: 1 Hz
  - Minimum life time @ 1A, 30V, 20 cpm: 100.000
  - Electrically isolated
- 2 photocouplers (shutters)
  - Max. switching voltage: 154 V
  - Max. current: 120 mA (switching and continuous)
- 1 odometer input
  - For counting odometer pulses of a maximum frequency of 2 kHz
- 1 IBIS slave interface
  - Baud rate up to 19.2 kBaud
  - Electrically isolated
- GNSS interface
  - Frequency band: GPS (L1), Glonass (L1, FDMA), Galileo (E1)
  - Standards: NMEA, RTCM 104
  - 32-channel GNSS architecture
  - Accuracy: 1.5 m
  - A-GPS
  - Time-To-First-Fix – cold start: lower than 35 s
  - Time-To-First-Fix – warm start / aided start: 1s
  - Odometer input for GNSS receiver
- RS232
  - D-Sub connector at front panel
  - Data rates up to 115 200 bit/s
  - 60-byte transmit/receive buffer
  - Handshake lines: RTS, CTS
  - Electrically isolated
- RS422/485
  - D-Sub connector at front panel
  - Full or half duplex
  - Electrically isolated
- 2 SA-Adapter slots for legacy serial I/O
  - For RS232, RS422/485 or IBIS master
- 1 SA-Adapter slot for RS232, RS422/485, IBIS or CAN
- 14 status LEDs
  - 4 for Ethernet link and activity status
  - 2 for general board status
  - 8 user LEDs

4 PCI Express® Mini Card slots

- For functions such as
  - Mobile service standards: GSM (2G), UMTS (3G), LTE (4G) and derivates
  - Wireless communication: WLAN / WiFi IEEE 802.11 and derivates
- 2 SIM card slots for each PCI Express® Mini Card
- PCI Express® and USB interface

Real-Time Clock

- Buffered by Gold Cap for up to 72 h

Electrical Specifications

- Supply voltage:
  - 24V and 36V nominal input voltage according to EN50155
  - 24V nominal input voltage according to ISO 7637-2 (E-mark) requirements
  - 10 to 50.4 V input voltage range
  - EN 50155 power interruption class S2
- Power consumption: 24 W typ.

Mechanical Specifications

- Dimensions: Height 66 mm x Width 390 mm x Length 215 mm
- Weight: approx. 3 kg

Environmental Specifications

- Temperature range (operation):
  - -40°C to 70°C (screened), with up to 85°C for 10 minutes according to class Tx (EN 50155)
  - Fanless operation
- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300 m to +3,000 m
- Shock: 50 m/s², 30 ms (EN 61373)
- Vibration (function): 1 m/s², 5 Hz – 150 Hz (EN 61373)
- Vibration (lifetime): 7.9 m/s², 5 Hz – 150 Hz (EN 61373)
- Conformal coating of internal components
- Compliant to protection class IP43 according to DIN60529 when mounted with connectors down

MTBF

- 198 000 h @ 40°C according to IEC/TR 62380 (RDF 2000)

Safety

- Flammability
  - UL 94V-0
- Fire Protection
  - EN 45545-2
- Electrical Safety
  - EN 50153
  - EN 50155

EMC Conformity (Automotive)

- ECE R10 (E-mark)
- ISO 10605 (ESD)

EMC Conformity (Railway)

- EN 50121-3-2

BIOS

- InsydeH2O™ UEFI Framework

Software Support

- Windows® 7
- Windows® Embedded Standard 7
- Linux

For more information on supported operating system versions and drivers, please see the online data sheet.

Configuration Options

CPU

- Intel® Core™ i7-3517UE
  - Dual Core, 1.7 GHz, 4 MB Cache, 17 W
- Intel® Core™ i3-3217UE
  - Dual Core, 1.6 GHz, 3 MB Cache, 17 W
- Intel® Celeron® 1047UE
  - Dual Core, 1.4 GHz, 2 MB Cache, 17 W
- Intel® Celeron® 927UE
  - Single Core, 1.5 GHz, 1 MB Cache, 17 W
- Intel® Celeron® 827E
  - Single Core, 1.4 GHz, 1.5 MB Cache, 17 W

Memory

- System RAM
  - 2 GB, 4 GB, 8 GB or 16 GB
- SATA hard-disk/solid state drive (mounted within housing)

I/O

- Ethernet
  - Two Fast Ethernet interfaces on two M12 connectors
- 1 HD audio
  - HD audio codec
  - Audio stereo in
  - Audio stereo out
  - SPDIF out
  - Available via 9-pin D-Sub connector instead of one SA-Adapter
- Antenna connectors
  - For functions like Wi-Fi, WIMAX, GSM/GPRS, UMTS, LTE in combination with PCI Express® Mini Card(s)
  - Reverse SMA connector
- SA-Adapter
  - Two (when audio is used) or three slots for RS232, RS422/485, IBIS master or CAN bus

Electrical Specifications

- Input voltages of 48V, 72V and 110V can be implemented on request
  - Acccording to EN 50155 class S2

As the product concept is very flexible, there are many other configuration possibilities. Please contact our sales team if you do not find your required function in the options. Please note that some of these options may only be available for large volumes.

For available standard configurations see the online data sheet.

Product Safety

Electrostatic Discharge (ESD)

Computer boards and components contain electrostatic sensitive devices. Electrostatic discharge (ESD) can damage components. To protect the board and other components against damage from static electricity, you should follow some precautions whenever you work on your computer.

- Power down and unplug your computer system when working on the inside.
- Hold components by the edges and try not to touch the IC chips, leads, or circuitry.
- Use a grounded wrist strap before handling computer components.
- Place components on a grounded antistatic pad or on the bag that came with the component whenever the components are separated from the system.
- Only store the board in its original ESD-protected packaging. Retain the original packaging in case you need to return the board to MEN for repair.

About this Document

This user manual is intended only for system developers and integrators, it is not intended for end users.

It describes the hardware functions of the system and connection of peripheral devices. It also provides additional information for special applications and configurations of the system.

The manual does not include detailed information on individual components (data sheets etc.). A list of literature is given in the appendix.

History

Issue	Comments	Date
E1	First issue	2014-12-09

Conventions

Indicates important information or warnings concerning the use of voltages that could lead to a hazardous situation which could result in personal injury, or damage or destruction of the component.

Indicates important information or warnings concerning proper functionality of the product described in this document.

The globe icon indicates a hyperlink that links directly to the Internet, where the latest updated information is available.

When no globe icon is present, the hyperlink links to specific elements and information within this document.

italics	Folder, file and function names are printed in *italics*.
bold	**Bold** type is used for emphasis.
`mono`	A `monospaced` font type is used for hexadecimal numbers, listings, C function descriptions or wherever appropriate. Hexadecimal numbers are preceded by `"0x"`.
comment	Comments embedded into coding examples are shown in green text.
IRQ# /IRQ	Signal names followed by a hashtag "#" or preceded by a forward slash "/" indicate that this signal is either active low or that it becomes active at a falling edge.
in/out	Signal directions in signal mnemonics tables generally refer to the corresponding board or component, "in" meaning "to the board or component", "out" meaning "from it the board or component".
	Blue vertical lines in the outer margin indicate sections where changes have been made to this version of the document.

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The WEEE directive does not apply to fixed industrial plants and tools. The compliance is the responsibility of the company which puts the product on the market, as defined in the directive; components and sub-assemblies are not subject to product compliance.

In other words: Since MEN does not deliver ready-made products to end users, the WEEE directive is not applicable for MEN. Users are nevertheless recommended to properly recycle all electronic boards which have passed their life cycle.

Nevertheless, MEN is registered as a manufacturer in Germany. The registration number can be provided on request.

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1 Product Description

1.1 Overview

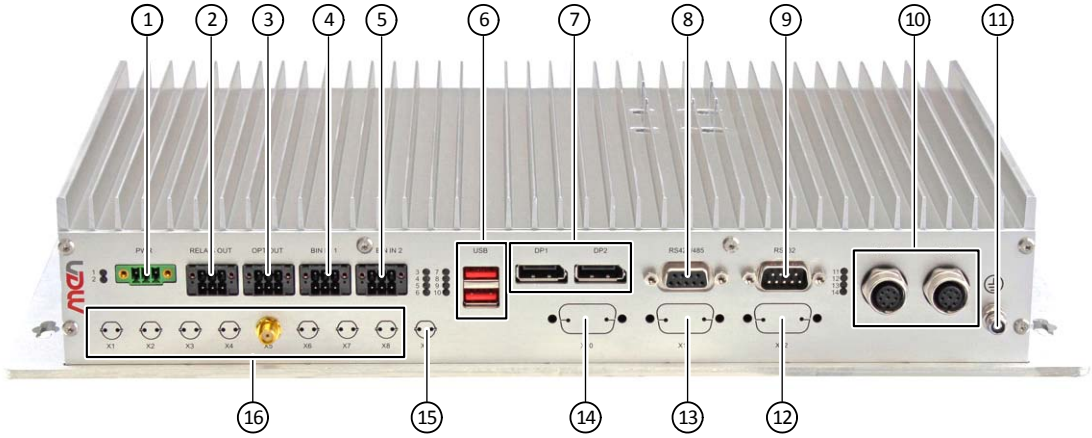
This chapter gives an overview of the box PC.

Figure 1. *The BL70W - overview*

1.1.1 External Interfaces

The following picture shows the BL70W front without antennas and flexible SA-Adapters.

Figure 2. *The BL70W - front interfaces*



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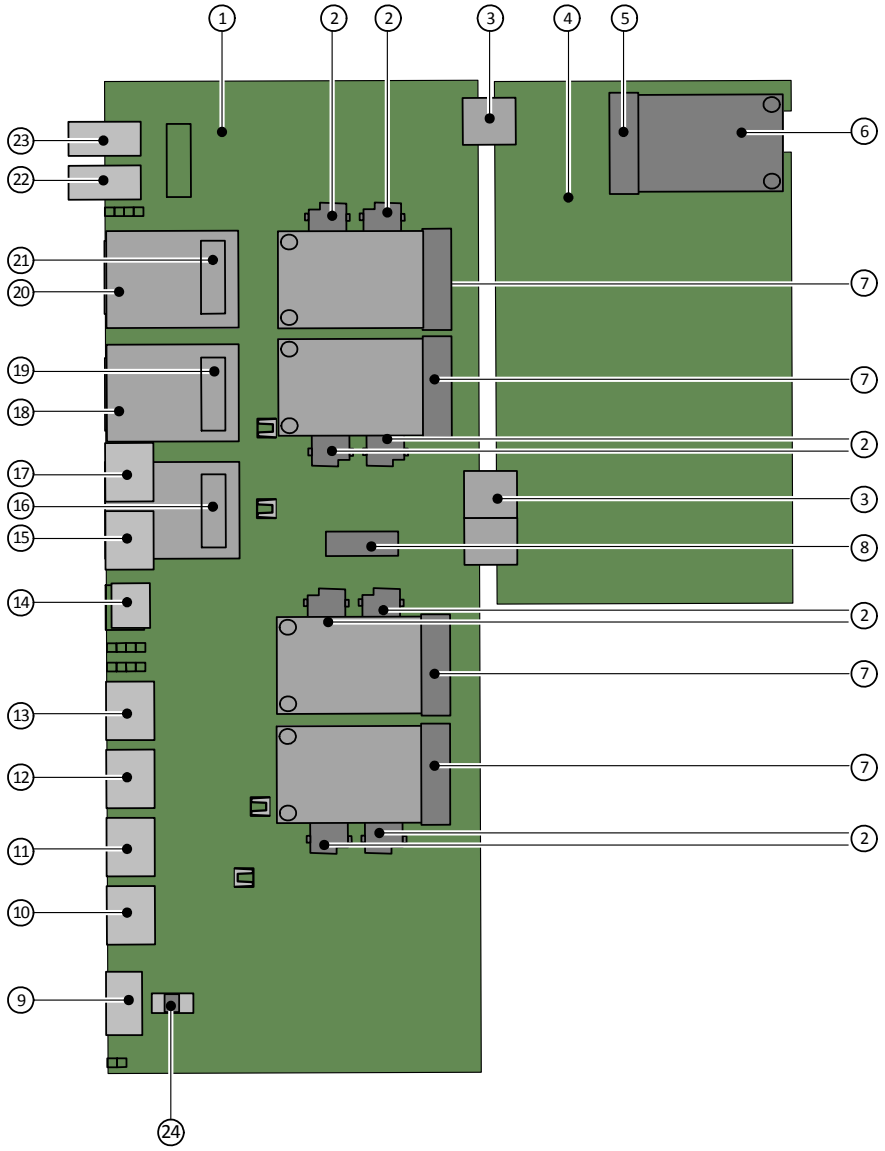
13. SA-Adapter connector for RS232, RS422/485 or IBIS
14. SA-Adapter connector for RS232, RS422/485, IBIS or CAN
15. Antenna connector for GNSS
16. Antenna connectors for PCI Express Mini Cards

1.1.2 Map of the System

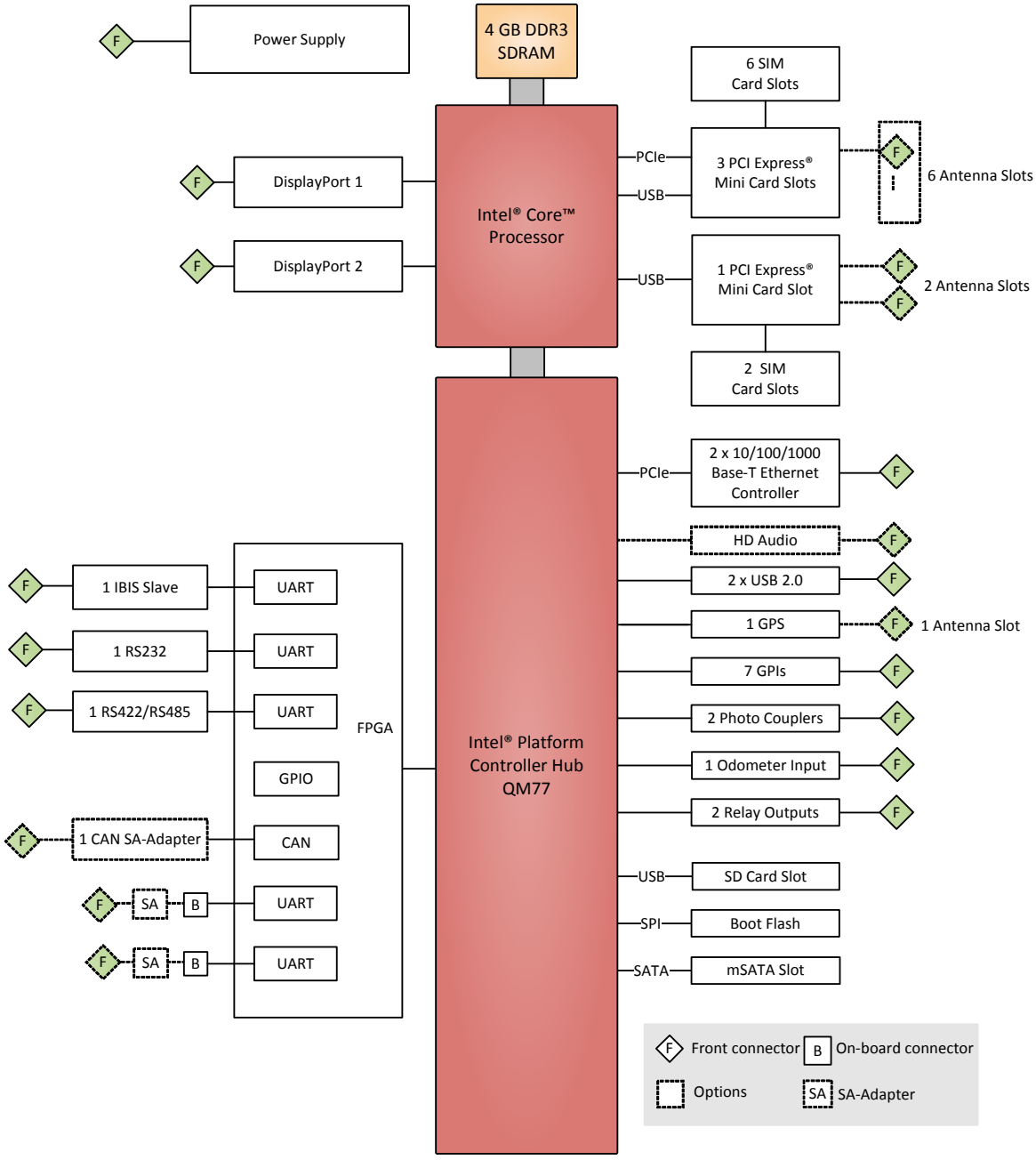
Figure 3. *Map of the system – view of the BL70W interior*



1 AE83 I/O Board	13 1 odometer input, 2 IBIS channels, 1 binary input
2 microSIM slot	14 2 USB 2.0 interfaces
3 Board-to-board connector	15 DisplayPort1
4 SC24 CPU Board	16 SA-Adapter connector for RS232, RS422/485 or CAN
5 mSATA slot	17 DisplayPort2
6 SD card slot (on board bottom)	18 RS422/485 interface
7 PCIe Mini Card slot	19 SA-Adapter connector for RS232, RS422/485 or IBIS
8 Connector for optional SATA disk	20 RS232 interface
9 PSU connector	21 SA-Adapter connector for RS232, RS422/485 or IBIS
10 2 relay outputs	22 Gigabit Ethernet 2 on M12 connector
11 2 optocoupler outputs	23 Gigabit Ethernet 1 on M12 connector
12 6 binary inputs	24 Fuse for protecting the system

1.2 Block Diagram

Figure 4. *Block diagram*



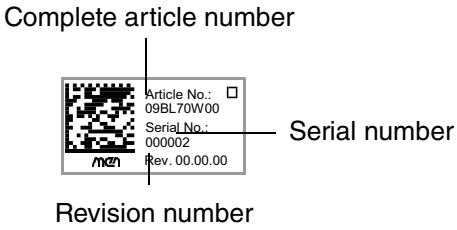
1.3 Product Identification

MEN user documentation may describe several different models and/or design revisions of the BL70W. You can find information on the article number, the design revision and the serial number on a label attached to the chassis.

- **Article number:** Gives the product's family and model. This is also MEN's ordering number. To be complete it must have 9 characters.
- **Revision number:** Gives the design revision of the product.
- **Serial number:** Unique identification assigned during production.

If you need support, you should communicate these numbers to MEN.

Figure 5. *Label giving the product's article number, revision and serial number*



2 Getting Started

2.1 Unpacking the System

After unpacking, check whether there are any transport or other damages on the system.

2.2 Configuring the Hardware

Check your hardware requirements before mounting the BL70W, since most modifications are difficult or even impossible to do when the box PC is mounted.

The following check list gives an overview on what you might want to configure. For installing the components mentioned below, the BL70W has to be opened.

See Chapter 2.2.1 Handling Internal Components on page 25 and Chapter 2.2.2 Opening the BL70W on page 25.

☑ PCI Express Mini Cards

Four PCI Express Mini Cards for wireless functions can be installed in the BL70W. MEN offers an LTE (4G) and a WLAN card as an accessory.

Refer to Chapter 2.2.3 Installing PCI Express Mini Cards on page 27 and Chapter 3.12 PCI Express Mini Card Interface on page 56 for details on the installation and functionality of the PCI Express Mini Cards.

☑ Antenna connectors

Nine antennas can be installed at the BL70W's front panel (such as SMA, reverse SMA, QMA, FME etc). MEN offers an HF antenna cable with U.FL connector to RP-SMA connector as an accessory.

Refer to Chapter 2.2.3 Installing PCI Express Mini Cards on page 27 and for details on the installation of the antenna connectors.

☑ microSD card

The BL70W is equipped with one microSD card slot. MEN provides a 4 GB microSD card as an accessory (other memory sizes are available on request).

Refer to Chapter 2.2.5 Installing a microSD Card on page 31 for information on how to install the SD card.

☑ mSATA disk

The BL70W is equipped with one mSATA disk slot. MEN provides an 8 GB mSATA disk as an accessory (other memory sizes are available on request).

Refer to Chapter 2.2.6 Installing an mSATA Drive on page 31 for information on how to install the mSATA disk.

☑ UART, GPS, IBIS extension through MEN standard SA-Adapters

The board provides three 10-pin I/O connectors for connection of three SA-Adapters for UART, GPS, IBIS or CAN functionality. MEN provides a range of standard adapters with different functionality.

Refer to Chapter 2.2.4 Installing SA-Adapters on page 29 and Chapter 3.10 Serial Interfaces on page 52 for details on the installation and functionality of the SA-Adapters.

See MEN's website for information on how to order the accessories.

2.2.1 Handling Internal Components

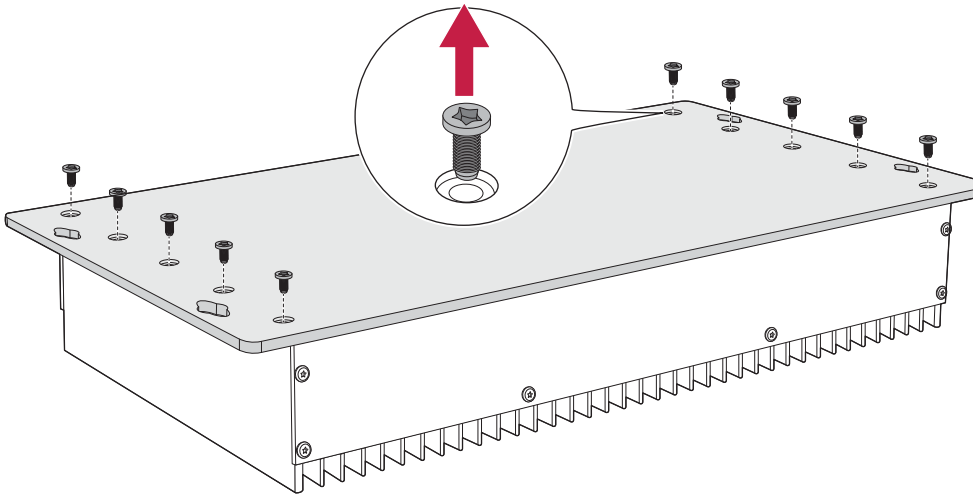
- Switch off or unplug the power supply of the box PC before working on internal components.
- Please observe the instructions concerning electrostatic discharge whenever you work on the inside of the computer system. See Chapter Electrostatic Discharge (ESD) on page 10.

2.2.2 Opening the BL70W

The PCI Express Mini Cards, the SA-Adapters, the microSIM cards, the mSATA slot and microSD card slot of the BL70W can be accessed after opening the housing.

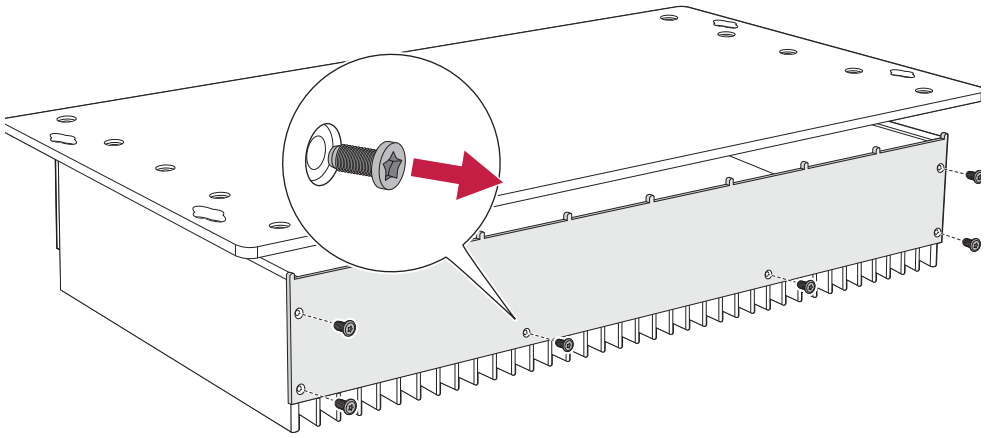
☑ For this purpose, remove the system's bottom panel fixed by ten M3x8 TX8 Torx screws.

Figure 6. *Screw positions on the bottom of the BL70W*



☑ To access the SD card slot, remove the rear panel of the unit fixed by six M3x8 TX8 Torx screws.

Figure 7. *Screw positions at the rear of the BL70W*

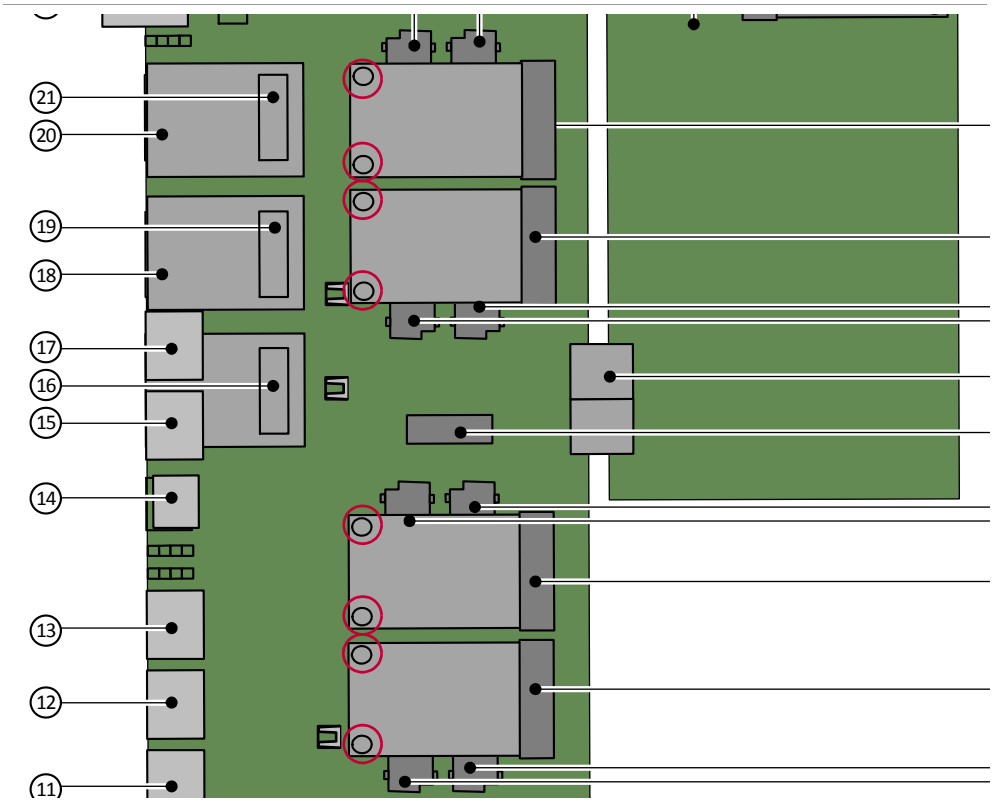


2.2.3 Installing PCI Express Mini Cards

Within its housing, the BL70W provides four PCI Express Mini card slots. The M2.5x8 screws required for installation are already screwed onto the board. Carry out the following steps to install a PCI Express Mini card.

☑ Untighten and remove the screws from the spacers (highlighted in red).

Figure 8. *Installing a PCI Express Mini card*



☑ Insert the PCI Express Mini card carefully at a 30° angle.

☑ Make sure that all the contacts are aligned properly and the card is firmly connected to the connector.

☑ Fix the card using the two screws removed before.

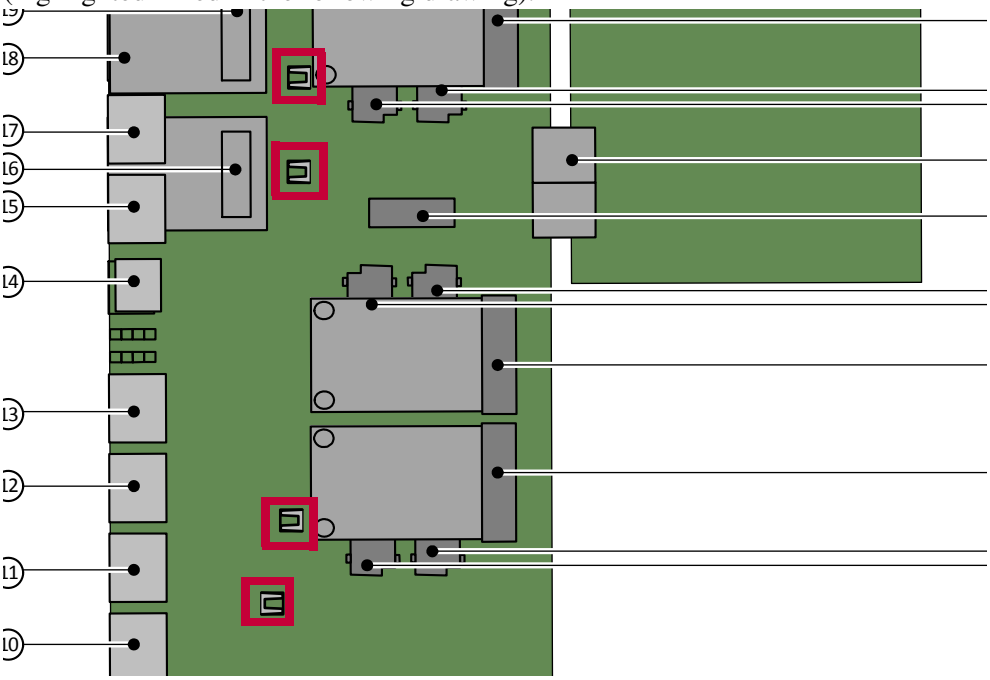
Antenna Connectors

MEN offers an HF antenna cable with U.FL connector to RP-SMA connector as an accessory.

> Please see the MEN website for ordering information.

Before being able to install the antenna on the BL70W's front panel, you have to break out the cover of the antenna slot, using a screw driver or a similar tool.

There is one mounting clip for fixing the antenna cable on the BL70W's PCB (highlighted in red in the following drawing).



Note: There is only one position in which the antenna can be completely inserted into the front panel slot. When properly inserted the antenna is fixed and cannot be turned anymore.

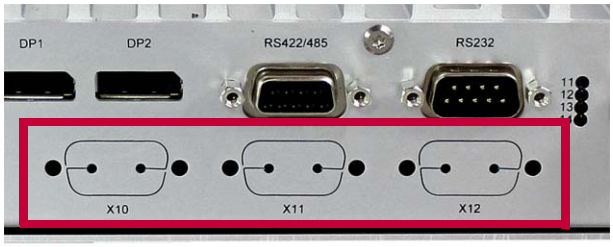
2.2.4 Installing SA-Adapters

Three SA-Adapters can be mounted in the BL70W on the 10-pin receptacle for slots X10, X11 and X12.

Carry out the following steps to install the SA-Adapters:

☑ Remove the front panel as described in Chapter 2.2.2 Opening the BL70W on page 25.

☑ Break out the covers of the front panel slots.



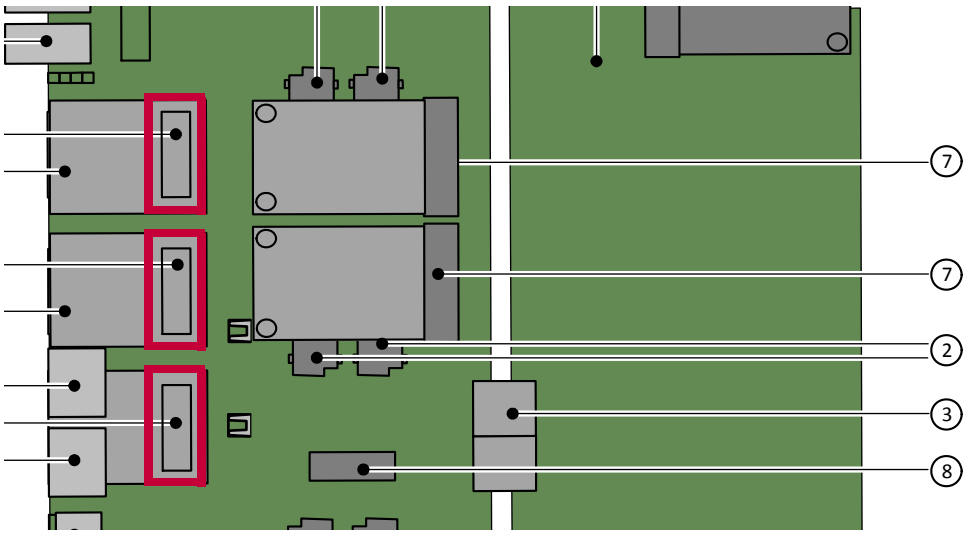
☑ Make sure that the adapter matches the standard dimensions for SA-Adapters.

> See also installation hints in the adapter's user manual or the list of compatible accessories in the BL70W data sheet on MEN's website.

☑ Remove the two front panel screws of the SA-Adapter.

☑ Carefully align the SA-Adapter connectors with the 10-pin connectors on the BL70W.

Figure 9. *10-pin SA-Adapter connectors (highlighted in red)*



☑ Press the SA-Adapter firmly onto the BL70W.

> Carefully align the front panel with the front connectors and the LEDs. Be careful not to damage the LEDs.

☑ Screw the front panel back onto the BL70W.

☑ Screw the SA-Adapter tightly to the BL70W front panel using the two pan-head screws removed before.

2.2.5 Installing a microSD Card

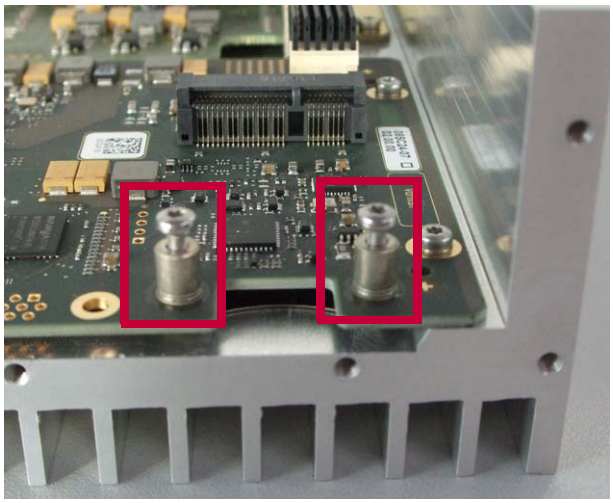
Within its housing, the BL70W provides one microSD card slot. Carry out the following steps to install a microSD card.

- ☑ The microSD card slot is positioned at the edge of the system, wedged between the PCB and the top of the housing.
- ☑ Insert the microSD card into the slot with the contacts facing to the PCB and the cut edge to the right side.
- ☑ Make sure that it clicks into place properly.
- ☑ To eject the microSD card, push it until it springs out, then simply pull it out.

2.2.6 Installing an mSATA Drive

Within its housing, the BL70W provides one mSATA slot. Two M2.5x8 screws are provided with the BL70W.

- ☑ Untighten and remove the screws from the spacers (highlighted in red).

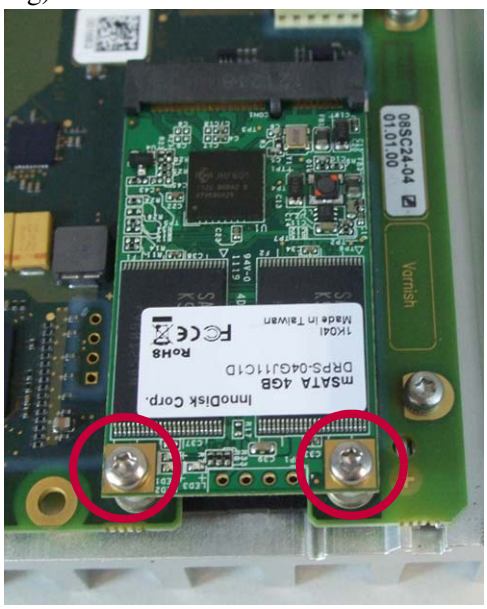


- ☑ Insert the mSATA drive carefully at a 30° angle.

- ☑ Make sure that all the contacts are aligned properly and the card is firmly connected to the mSATA connector.

☑ Align the spacers and the holes and insert the screws into the spacers from above the mSATA disk.

☑ Fix the card by tightening the screws (highlighted in red in the following drawing).

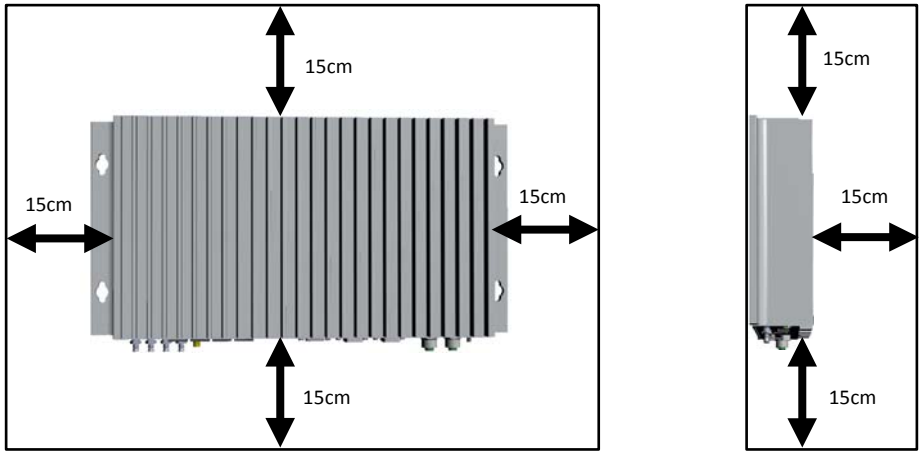


2.3 Mounting the BL70W

Please consider the following instructions when installing the BL70W:

- Do not install the system near any heat sources (e.g. radiators, heat registers).
- Keep the system away from liquids. Avoid exposure to dripping or splashing.
- Keep a free space of 15 cm around the housing to ensure cooling (except on the mounting side).

Figure 10. *Mounting distances required for the box PC*



- The connector side should face down.
- The BL70W provides four mounting holes for installation.
- Use M5 countersink head screws.

See Chapter 7.2 Dimensions of the BL70W Box PC on page 78 for the exact dimensions of the box PC and the positions of the mounting holes and connectors.

2.3.1 Installing the BL70W in a 19" Rack

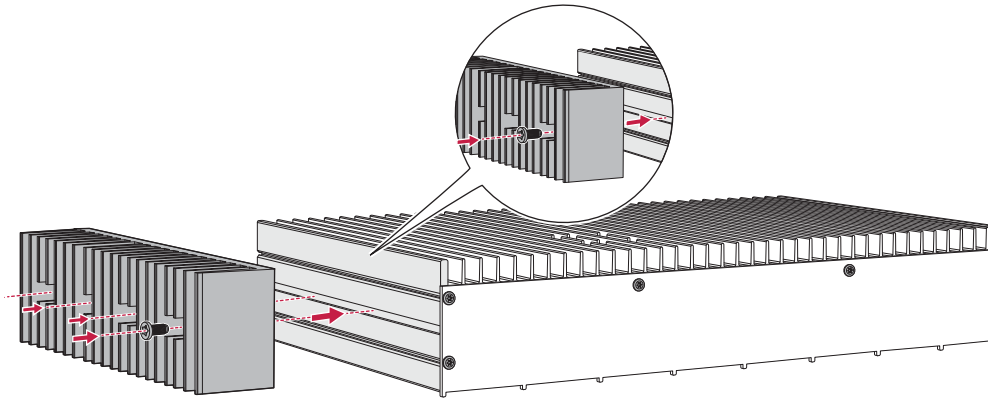
MEN offers a 1.5U mounting kit which makes it possible to install the BL70W in a 19" rack (05BL01-00).

Please see MEN's website for more information.

☑ Remove the BL70W's bottom panel as described in Chapter 2.2.2 Opening the BL70W on page 25.

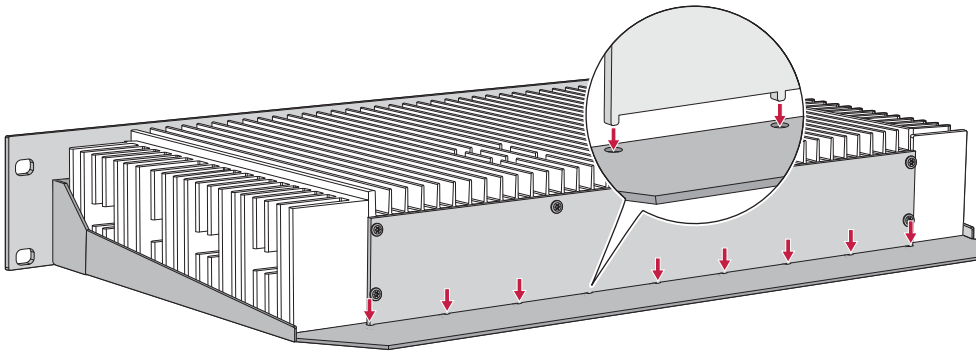
☑ Remove five of the screws fastening the front panel (highlighted in red in the following picture). Do not remove the front panel.

☑ Install the two heats sinks supplied with the kit at the sides of the BL70W using four M2.5x10 TX8 Torx screws for each heat sink. The screws are included in the delivery of the 05BL01-00 kit.



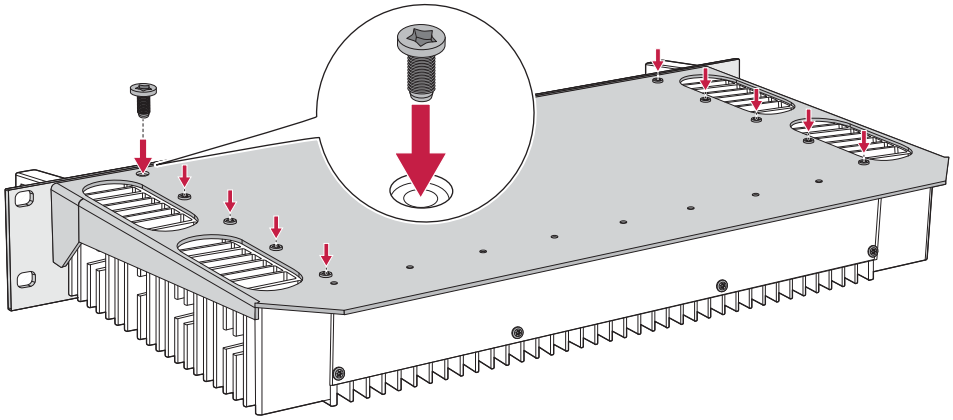
☑ Insert the box PC into the opening in the kit's front panel.

☑ Take care that the small studs at the bottom of the front and rear panel of the box PC are aligned with the corresponding holes in the bottom plate of the mounting kit.



☑ Press the BL70W down onto the bottom plate.

☑ Screw the BL70W onto the kit's bottom plate using the ten screws removed before.



☑ Fix the BL70W at the kit's front panel using the five M3x8 TX8 Torx screws removed before.

☑ Fasten the BL70W in the frame in the 19" switching cabinet using four M6x16 screws.

2.4 Connecting an Earthing Cable

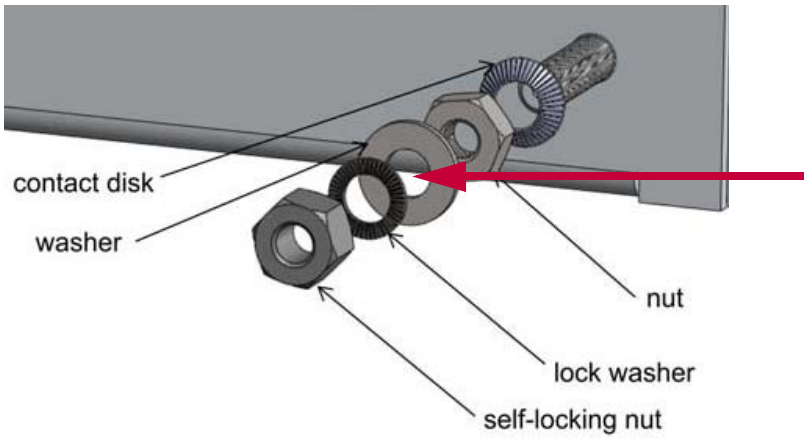
The BL70W features an earthing stud on the right side of the front panel (see Figure 2, The BL70W - front interfaces on page 19). A protective earth connection is essential for the system to meet its EMC specifications.

An earthing cable has to be connected to the earthing stud before any other connections! For disassembling the system, the earthing cable has to be detached last.

Carry out the following steps to connect an earthing cable:

☑ Take an earthing cable with a cross section of at least 0.75 mm².

☑ Slide the cable onto the stud between the washer and the lock washer as indicated in the following picture:



☑ Fasten the cable by tightening the nut.

2.5 Electrical Connection

- Ensure that the box PC is completely configured and mounted before connecting and applying power to the system.
- Implement a readily accessible disconnect device external to the box PC for complying with the EN 60950-1 standard.
- Make sure that the voltage of the power supply conforms with the voltage on the type plate.
- Ensure that the power supply (power socket) is grounded correctly and that the power cable is intact and undamaged.
- Do not switch on the system if there are damages on the power cable or plug.
- Use power cables which are approved for the power supply in your country.
- Power supplies have to be grounded.
- Connect the PSU to the power supply via the power cable.

2.6 Starting up the System

Make sure that all peripheral devices are connected to the system before connecting an external power supply and switching on the system.

You can use the following check list when installing the unit for the first time and with minimum configuration.

- ☑ Connect a USB keyboard and mouse to the USB connector at the front panel.
- ☑ Connect a flat-panel display capable of displaying the resolution of 1024x786 to the DisplayPort connector of the BL70W.
- ☑ Power up the system. See Chapter 3.1 Power Supply on page 38.
- ☑ You can start up the BIOS setup menu by hitting the <F2> key.
- ☑ Now you can make configurations in BIOS.
- ☑ Observe the installation instructions for the respective software.

2.7 Installing Operating System Software

The board supports Windows 7 and Linux.

By default, no operating system is installed on the board. Please refer to the respective manufacturer's documentation on how to install operating system software!

2.8 Installing Driver Software

For a detailed description on how to install driver software please refer to the respective documentation of the software package to be installed.

You can find any software available on the BL70W pages on the MEN website.

3 Functional Description

The following describes the individual functions of the system and their configuration. There is no detailed description of the individual controller chips and the CPU. They can be obtained from the data sheets or data books of the semiconductor manufacturer concerned.

3.1 Power Supply

The BL70W is supplied with a nominal input voltage of 24 VDC and 36 VDC (10 to 50.4 V input voltage range) via a 3-pin COMBICON connector. You can find pin 1 at the left (see Figure 11, PSU connector at BL70W front).

The onboard power supply generates all the necessary internal voltages.

Connector type:

- 3-pin COMBICON receptacle (Phoenix Contact 1843800 MC 1,5/ 3-GF-3,5)

Mating connector:

- 3-pin COMBICON plug, e.g., Phoenix Contact 1863314 MCVR 1,5/ 3-STF-3,5

Figure 11. *PSU connector at BL70W front*

Table 1. *Pin assignment of PSU connector*

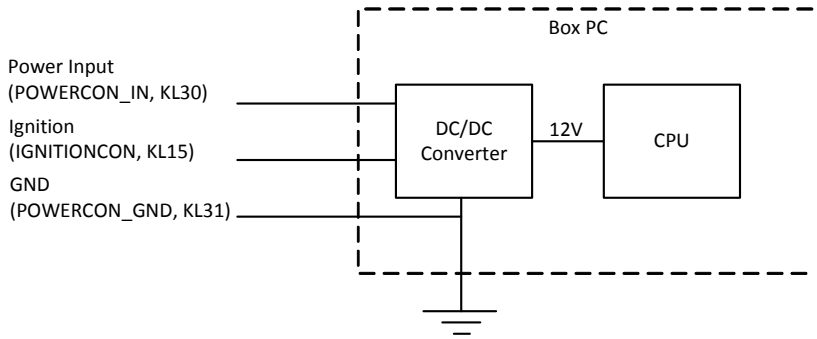
1	POWERCON_IN	Power input
2	POWERCON_GND	Power input ground
3	IGNITIONCON	Ignition

3.1.1 Ignition

Using the ignition pin, the start-up and shut-down of the BL70W can be controlled.

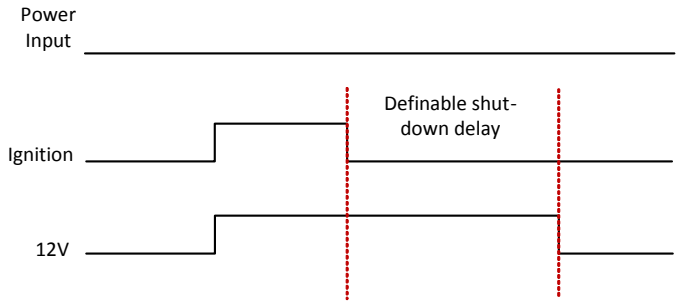
If the ignition pin (IGNITIONCON, KL15) is connected to the power input pin (POWERCON_IN, KL30) via a switch or a controller, switching on and off of the BL70W can be controlled without having to disconnect the power supply.

Figure 12. *Connection of power pins from PSU*



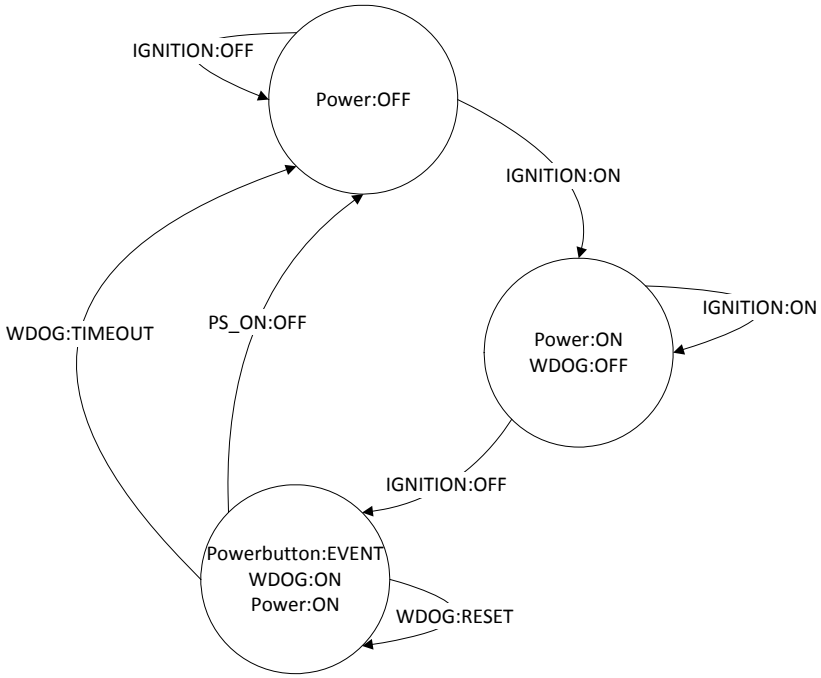
When the ignition is turned on, the 12 V supply voltage is also switched on (see Figure 13, Ignition behavior). When the ignition is turned off, the input voltage is not switched off at once but can be supplied for a user-defined time (shut-down delay) so that the operating system of the BL70W can shut down in a controlled way.

Figure 13. *Ignition behavior*



The shut-down delay can be set using a watchdog. If the ignition signal is disabled and the watchdog is running, it is possible to reset the watchdog timer by software using the WDOG_EN signal (see Figure 30, SMB 0x4E) to avoid a power shutdown. If the watchdog is running and the timer is not restarted, the box computer is forced into power down mode after approximately 5 minutes.

Figure 14. *Ignition and watchdog state diagram*



The ignition pin (pin 3) can also be permanently connected to the power input pin (pin 1). In this case the BL70W is starting up as soon as the supply voltage is connected and switched off as soon as the supply voltage is disconnected without a delay for shutting down the operating system.

3.2 Real-Time Clock

The board includes a real-time clock connected to the processor as a system RTC. The RTC has an accuracy of approximately 1.7 seconds/day (11 minutes/year) at 25°C.

For data retention during power off the RTC is backed up by a supercapacitor. The supercapacitor gives an autonomy of up to 72 hours when fully loaded.

The real-time clock device is connected to the CPU via SMBus. Due to its reduced current consumption, the life time of the battery or supercapacitor can be increased considerably compared to the RTC integrated in the CPU.

MEN provides a dedicated software driver for the RTC device in order to set date and time as usual in Windows. For a detailed description of the functionality of the driver and for downloading the software please refer to the drivers' documentation on MEN's website.

3.3 Processor Core

The following processor options are available on the BL70W:

Table 2. *Processor core options on BL70W*

Processor Type	Core Frequency	Cores/ Threads	Power Consumption	Cache	AMT Support
Core i7-3517UE	1.7 GHz	2/4	17 W	4 MB	yes
Core i3-3217UE	1.6 GHz	2/4	17 W	3 MB	no
Celeron 1047UE	1.4 GHz	2/2	17 W	2 MB	no
Celeron 927UE	1.5 GHz	1/1	17 W	1 MB	no
Celeron 827E	1.4 GHz	1/1	17 W	1.5 MB	no

3.3.1 Intel Active Management Technology (AMT)

BL70W box PCs equipped with an Intel Core i7 processor support Intel Active Management Technology (AMT 8.0). Intel AMT is powered by a separate hardware engine in Intel chipsets which enables e.g. out-of-band (OOB) diagnostics, remote control, IDE-Redirect, Serial-over-LAN (SOL), agent presence checking and network traffic filtering..

MEN provides an application note on how to switch on the AMT functionality and log onto the CPU board via VNC afterwards. See MEN's website.

If the supercapacitor and/or the battery is empty, the BL70W loses its complete AMT settings due to Intel's security standards.

3.3.2 Thermal Considerations

The operating temperature range of the BL70W depends on the system configuration (CPU, PCIeMiniCards, Ethernet, USB, ...)

The power dissipation of the system also depends on the environmental conditions. It has a typical power dissipation of 24 W.

The system is designed for a maximum operating temperature of +70°C (+85°C for 10 minutes). The minimum temperature is -40°C for all processors.

As an option, a wider housing with additional cooling fins is available, enabling permanent operation at +85°C.

3.4 Memory and Mass Storage

3.4.1 DRAM System Memory

The standard model of the BL70W is equipped with 4 GB of DDR3 SDRAM. Up to 16 GB are supported.

3.4.2 Boot Flash

The BL70W is equipped with a boot Flash containing its BIOS.

3.4.3 microSD Card Slot

Within its housing, the BL70W provides one microSD card slot. The slot supports the Secure Digital 2.0 specification (microSDHC) with a storage capacity of 2 up to 16 GB and a data transfer rate of 25 MB/s.

See Chapter 2.2.5 Installing a microSD Card on page 31 for information on how to install the microSD card.

3.4.4 mSATA Slot

Within its housing, the BL70W provides one mSATA slot.

See Chapter 2.2.6 Installing an mSATA Drive on page 31 for information on how to install an mSATA disk.

3.4.5 SATA Hard Disk (Optional)

The BL70W offers the possibility to install an additional SATA hard disk in the housing on a special mounting frame.

Please contact the MEN sales team for further information.

3.5 Graphics

3.5.1 DisplayPort Interfaces

Two DisplayPort interface are available at the front panel. The maximum supported resolution is 2560x1600 at 60 Hz. The interfaces offer AUX channel support and hot plug detection.

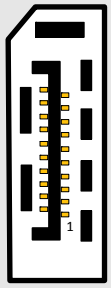
Connector type:

- 20-pin DisplayPort receptacle

Mating connector:

- 20-pin DisplayPort plug

Table 3. *Pin assignment of 20-pin DisplayPort connector*



	20	POWER	19	RETURN PWR
	18	DP_HOTPLUG	17	DP_AUX-
	16	GND	15	DP_AUX+
	14	CONFIG2	13	CONFIG1
	12	LANE_3-	11	GND
	10	LANE_3+	9	LANE_2-
	8	GND	7	LANE_2+
	6	LANE_1-	5	GND
	4	LANE_1+	3	LANE_0-
	2	GND	1	LANE_0+

Table 4. *Signal mnemonics of 20-pin DisplayPort connector*

Signal	Direction	Function
GND	-	Ground
DP_AUX-, DP_AUX+	in/out	Bi-directional half-duplex auxiliary channels for device management and device control
CONFIG1, CONFIG2	-	Connected to Ground
DP_HOTPLUG	in	Hot Plug Detect
LANE_[3..0]+, LANE_[3..0]-	out	Main Link data lanes
POWER	out	Power for connector (3.3 V, 500 mA)
RETURN PWR	-	Return for Power

3.5.2 Other Graphics Interfaces

MEN offers a starter kit including a DisplayPort to DVI adapter.

In addition, many third-party suppliers offer active adapters from DisplayPort to other graphics interfaces. The maximum resolution depends on the adapter used. Supported interfaces include:

- HDMI
- Single-link DVI
- Dual-link DVI
- VGA

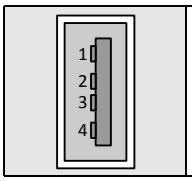
3.6 USB Interface

The BL70W provides two USB 2.0 interfaces at the front panel via two automotive USB connectors. The automotive USB connectors are 100% compliant to standard connectors but offer a more robust connection.

Connector types:

- 4-pin USB Series A receptacle according to Universal Serial Bus Specification Revision 1.0
- Mating connector:
  4-pin USB Series A plug according to Universal Serial Bus Specification Revision 1.0

Table 5. *Pin assignment of USB front-panel connectors*



1	+5V
2	USB_D-
3	USB_D+
4	GND

Table 6. *Signal mnemonics of USB front-panel connectors*

Signal	Direction	Function
+5V	out	+5 V power supply
GND	-	Digital ground
USB_D+, USB_D-	in/out	USB lines, differential pair

3.7 Ethernet Interface

The BL70W provides two Gigabit Ethernet ports at the front.

Connector type:

- 8-pin M12 receptacle, female, A-coded 90° (Phoenix Contact 1436974 SACC-DSIV-FS-8CON-L90 SCO)

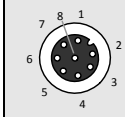
Mating connector:

- 8-pin M12 plug, male, A-coded

MEN offers a starter kit including an M12 to RJ45 adapter for making the Ethernet interfaces available on standard Ethernet connectors.

For ordering details please consult MEN's website.

Table 7. *Pin assignment of Ethernet front-panel connectors*



	1000Base-T	10/100Base-T
1	BI_DC-	
2	BI_DD+	
3	BI_DD-	
4	BI_DA-	TX-
5	BI_DB+	RX+
6	BI_DA+	TX+
7	BI_DC+	-
8	BI_DB-	RX-

Table 8. *Signal mnemonics of Ethernet front-panel connectors*

Signal	Direction	Function
BI_Dx+/-	in/out	Differential pairs of data lines for 1000Base-T
RX+/-	in	Differential pair of receive data lines for 10/100Base-T
TX+/-	out	Differential pair of transmit data lines for 10/100Base-T

3.7.1 Ethernet Status LEDs

The BL70W provides a total of four Ethernet status LEDs, two for each Ethernet channel. They signal the link and activity status (different LED behavior can be implemented on demand).

Figure 15. *Position of Ethernet LEDs at BL70W front (highlighted in red)*

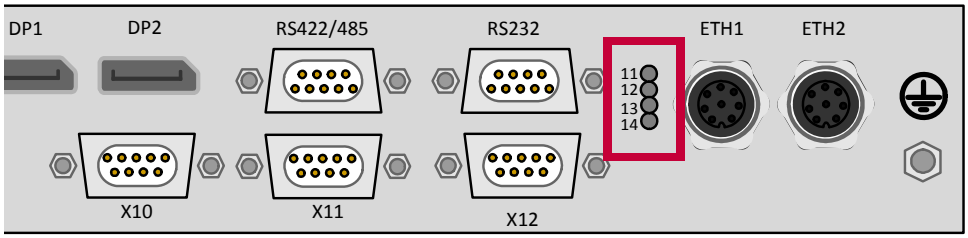


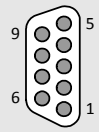
Table 9. *Ethernet status LEDs*

LED	Description	Color	Function
11	Port 1 link	green	on, when connection established
12	Port 1 activity	yellow	on, when Ethernet communication on Rx or Tx
13	Port 2 link	green	on, when connection established
14	Port 2 activity	yellow	on, when Ethernet communication on Rx or Tx

3.8 HD Audio (Optional)

As an option, the BL70W can be equipped with a high definition audio interface implemented via the Realtek ALC268 codec and available on a standard 9-pin D-Sub connector at the front panel.

Table 10. *Pin assignment of the HD audio interface*



9	AUDIO_IN_R	5	AUDIO_SPDIF
8	AUDIO_GND	4	AUDIO_IN_L
7	AUDIO_OUT_R+	3	AUDIO_OUT_R-
6	AUDIO_OUT_L-	2	AUDIO_GND
		1	AUDIO_OUT_L+

Table 11. *Signal mnemonics of the HD audio interface*

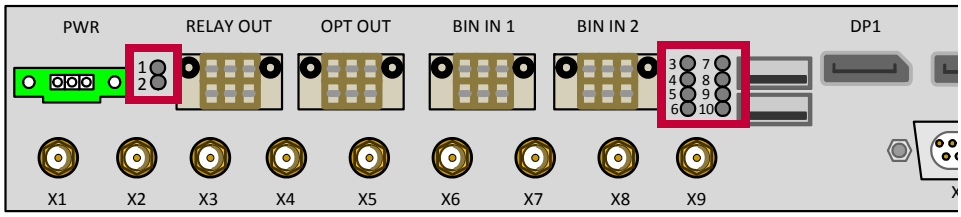
Signal	Direction	Description
AUDIO_EXT_OUT_L±/R±	out	Line out, left and right, differential signal pairs
AUDIO_EXT_IN_L/R	in	Line in, left and right
AUDIO_EXT_GND	-	Analog ground
AUDIO_EXT_SPDIF	out	S/PDIF output

3.9 Status and User LEDs

In addition to the four Ethernet status LEDs, the BL70W provides two status LEDs and eight general status LEDs. One of the status LEDs signals whether the onboard power generated by the BL70W's on-board DC/DC converter is within valid range, the other signals the system status (see Chapter 3.9.1 Status LED on page 51 for a detailed description of the LED's behavior).

The eight user LEDs can be controlled via an I/O expander on the SMBus. The LED can be used freely depending on an application's requirements. See Chapter 4.1 SMBus Overview for information on how to access the LEDs.

Figure 16. *Status and user LEDs on the BL70W's front panel (highlighted in red)*



The following table shows a list of all status and user LEDs with their functionality or default state.

Table 12. *Status and user LEDs on the BL70W*

Number	Description	Color	Function
1	Power good	green	on, when internal 12V active
2	Status LED (diagnostic)	yellow	see Chapter 3.9.1 Status LED on page 51
3	User LED A	yellow	default: off
4	User LED B	yellow	default: off
5	User LED C	yellow	default: off
6	User LED D	yellow	default: off
7	User LED E	yellow	default: off
8	User LED F	yellow	default: off
9	User LED G	yellow	default: off
10	User LED H	yellow	default: off

3.9.1 Status LED

The status LED (LED2) is connected to the system's board controller.

It has the following behavior:

- off, if system is in S5 state
- blinking at less than 0.5 Hz if system is in S3 state
- on, if system is in S0 state and BIOS has sent live sign after power-up
- it flashes repeatedly n times according to an error code and pauses for one second until the system is restarted or completely powered-off, if system is in error condition and error code is n. See the following table for supported error codes.

Table 13. *Error codes signaled by board management controller via LED flashes*

Number of Flashes	Error	Description
0	*CPUBCI_ERR_NONE*	No error
1	*CPUBCI_ERR_33V*	3.3 V failure
2	*CPUBCI_ERR_INP*	Input voltage failure
3	*CPUBCI_ERR_NO_EXT_PWR_OK*	External power supply failure
4	*CPUBCI_ERR_CPU_TOO_HOT*	CPU temperature too high
5	*CPUBCI_ERR_BIOS_TIMEOUT*	BIOS startup failure
>5		Internal error

3.10 Serial Interfaces

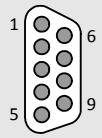
3.10.1 RS232 Interface

The BL70W provides one isolated RS232 interface with a baud rate of up to 115.2 kbaud. The interface (COM1) supports Rx, Tx, RTS and CTS signals.

Connector types

- 9-pin D-Sub plug according to DIN41652/MIL-C-24308, with thread bolt UNC4-40
- Mating connector:
  9-pin D-Sub receptacle according to DIN41652/MIL-C-24308, available for ribbon cable (insulation piercing connection), hand-soldering connection or crimp connection

Table 14. *Pin assignment of 9-pin D-Sub connector for RS232*



	1	-	6	-
	2	COM0_RXD	7	COM0_RTS#
	3	COM0_TXD	8	COM0_CTS#
	4	-	9	-
	5	GND		

Table 15. *Signal mnemonics of RS232 connector*

Signal	Direction	Function
GND	-	Ground
+5V	out	+5V supply voltage
CTS#	in	Clear to send
RTS#	out	Request to send
RXD	in	Receive data
TXD	out	Transmit data

3.10.2 RS422/485 Interface

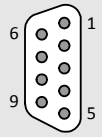
The BL70W provides one isolated RS422/485 full and half duplex interface with a baud rate of up to 1 Mbaud. It is possible to switch between half and full duplex mode via application software. The RS422/RS485 interface is switched between RS422 and RS485 using the RTS signal of the used UART interface (COM2).

Connector types

- 9-pin D-Sub receptacle according to DIN41652/MIL-C-24308, with thread bolt UNC4-40
- Mating connector:
  9-pin D-Sub plug according to DIN41652/MIL-C-24308, available for ribbon cable (insulation piercing connection), hand-soldering connection or crimp connection

3.10.2.1 Full-Duplex Interface

Table 16. *Pin assignment of the 9-pin D-Sub receptacle – full duplex*



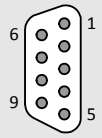
6	I-VCC	1	-
7	-	2	-
8	TX-	3	TX+
9	RX-	4	RX+
		5	I-GND

Table 17. *Signal mnemonics of RS422/485 interface – full duplex*

Signal	Direction	Description
I-GND	-	Isolated reference potential
RX+/-	in	Receive data (differential pair)
TX+/-	out	Transmit data (differential pair)
I-VCC	out	Isolated power supply

3.10.2.2 Half-Duplex Interface

Table 18. *Pin assignment of the 9-pin D-Sub receptacle – half duplex*



6	I-VCC	1	-
7	-	2	-
8	RX/TX-	3	RX/TX+
9	-	4	-
		5	I-GND

Table 19. *Signal mnemonics of RS422/485 interface – half duplex*

Signal	Direction	Description
I-GND	-	Isolated reference potential
RX+/-	in	Receive data
TX+/-	out	Transmit data
I-VCC	out	Isolated power supply

3.11 Serial Interfaces via SA-Adapter

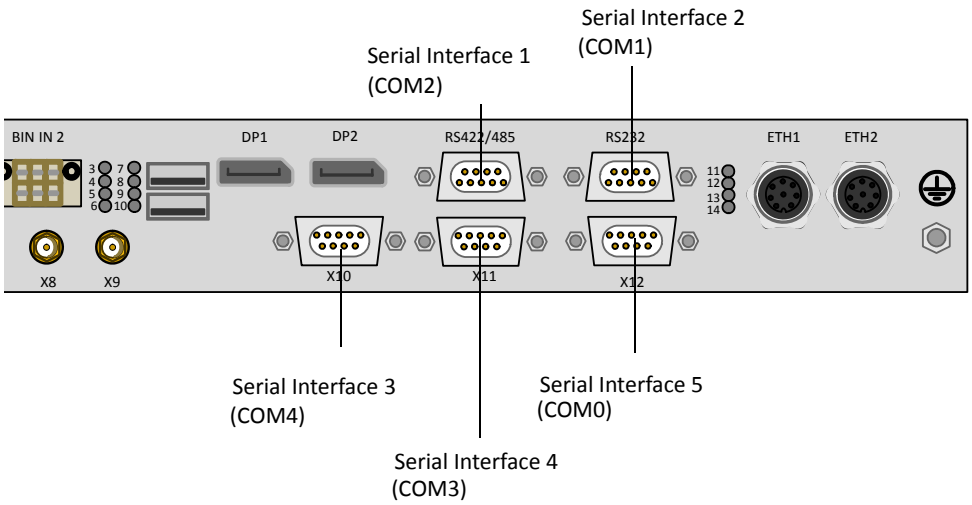
The BL70W offers the possibility to provide three additional serial interfaces at the front of the BL70W using MEN standard SA-Adapters. This way, a serial interface can be used which can be flexibly configured as needed.

Serial interface 3 (COM4) can be used for UART or CAN bus functionality (for CAN bus functionality a special product version is required), slots 4 (COM3) and 5 (COM0) can be used for UART, IBIS or GPS.

If you use the 08SA15-00 SA-Adapter with SGPIO functionality in slot 5 (X12) you have to change a setting in the FPGA to switch from UART to SGPIO. See Chapter 5.1 GPIO Controller Instance 1 on page 74.

If you want to use an SA-Adapter at serial interface 3 (X10) you have to activate the UART in the system's FPGA. See Chapter 5.1 GPIO Controller Instance 1 on page 74.

Figure 17. *Position of serial interfaces on BL70W front*



See Chapter 2.2.4 Installing SA-Adapters on page 29 for installation instructions.

- See MEN's website for a list of SA-Adapters which can be used on the box PC.
- Please contact MEN's sales team for information about possible configurations and special board versions.

3.12 PCI Express Mini Card Interface

The BL70W supports the PCI Express Mini Card standard. Its four PCI Express Mini Card slots are located within the housing.

Refer to Figure 3, Map of the system – view of the BL70W interior on page 20 for the exact position of the PCI Express Mini Card slot.

As an option, the BL70W can also be equipped with fourPCI Express Mini Card slots compatible with half-size modules.

See Chapter 2.2.3 Installing PCI Express Mini Cards on page 27 for information on how to install the PCI Express Mini Cards in the box PC.

Three of the PCIe MiniCard sockets on the BL70W support both a USB and a PCIe interface. The fourth socket only supports USB.

The power supply of the PCIe MiniCard can be reset via GPIO. This power reset is required when switching from one micro-SIM card to another.

See Chapter 4.1 SMBus Overview on page 65 for more information on how to switch the micro-SIM cards.

Micro-SIM Cards

The BL70W provides eight micro-SIM Card sockets. Two micro-SIM cards are attached to one PCIe MiniCard socket. Either micro-SIM card A or micro-SIM card B can be connected to the PCI Express Mini Card. By default the PCI Express Mini card is connected to micro-SIM card A.

See Chapter 4.1 SMBus Overview on page 65 for more information on how to switch the micro-SIM cards.

3.12.1 Connection of PCI Express Mini Cards

The PCI Express Mini card is connected using a 52-pin standard PCI Express Mini Card connector. The following standard signals are supported (signal directions according to PCI Express Mini Card standard):

Table 20. *Pin assignment of 52-pin PCI Express Mini Card connector*

Pin	Signal	Pin	Signal
51	Reserved	52	+3.3Vaux
49	Reserved	50	GND
47	Reserved	48	+1.5V
45	Reserved	46	LED_WPAN#
43	GND	44	LED_WLAN#
41	+3.3Vaux	42	LED_WWAN#
39	+3.3Vaux	40	GND
37	GND	38	USB_D+
35	GND	36	USB_D-
33	PETp0	34	GND
31	PETn0	32	SMB_DATA
29	GND	30	SMB_CLK
27	GND	28	+1.5V
25	PERp0	26	GND
23	PERn0	24	+3.3Vaux
21	GND	22	PERST#
19	Reserved	20	W_DISABLE#
17	Reserved	18	GND
Mechanical Key			
15	GND	16	UIM_VPP
13	REFCLK+	14	UIM_RST
11	REFCLK-	12	UIM_CLK
9	GND	10	UIM_DATA
7	CLKREQ#	8	UIM_PWR
5	Reserved	6	1.5V
3	Reserved	4	GND
1	WAKE#	2	+3.3Vaux

Table 21. *Signal mnemonics of 52-pin PCI Express Mini Card connector*

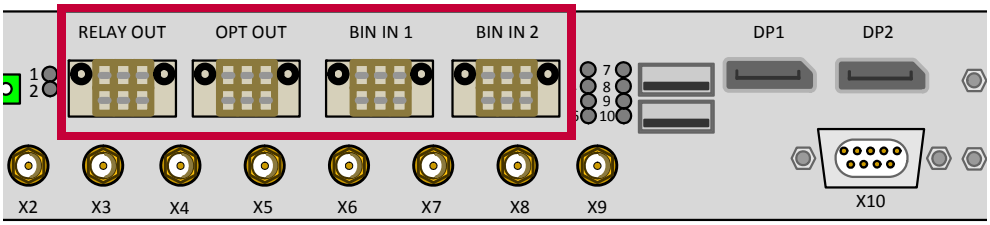
	Signal	Direction	Function
Power	GND	-	Ground
	+3.3Vaux	out	3.3V source
	1.5V	out	1.5V source
SIM card	UIM_PWR	in	microSIM card power
	UIM_DATA	in/out	microSIM card data
	UIM_CLK	in	microSIM card clock
	UIM_RST	in	microSIM card reset
	UIM_VPP	in	not connected
PCI Express	REFCLK-/ REFCLK+	out	PCI Express differential reference clock
	PERn0/PERp0	in	PCI Express receive signals
	PETn0/PETp0	out	PCI Express transmit signals
Auxiliary Signals	CLKREQ#	in	Clock request
	PERST#	out	Reset for the Mini Card
	W_DISABLE#	out	Wireless disable
	WAKE#	in	Wake signal
	SMB_CLK	out	System management bus clock
	SMB_DATA	in/out	System management bus data
USB	USB_D-	in/out	USB line
	USB_D+	in/out	USB line
Communications - specific signals	LED_WWAN#	in	not connected
	LED_WLAN#	in	not connected
	LED_WPAN#	in	not connected

Please refer to the PCI Express Mini Card Specification for further details. See Chapter 7.1 Literature and Web Resources on page 77.

3.13 6-Pin Headers

The relay outputs, the binary inputs, the IBIS signals, the odometer input and the photocoupler signals are available on four 6-pin PCB headers at the BL70W front.

Figure 18. *Spring cage terminal blocks*



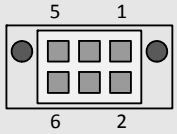
Connector type:

- 6-pin header (printed circuit board connector), 3.5 mm, Phoenix Contact DMC 1,5/ 3-G1F-3,5-LR P20THR - 1787027

Mating connector:

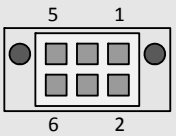
- 6-pin plug (printed circuit board connector), e.g. Phoenix Contact DFMC 1,5/ 3-ST-3,5-LR - 1790496

Table 22. *Pin assignment of relay out connector*



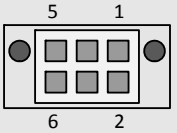
5	/ REL2_P	3	REL1_N	1	REL1_P
6	REL2_N	4	REL2_P	2	/ REL1_P

Table 23. *Pin assignment of opt out connector*



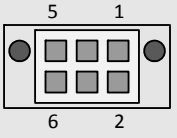
5	OPT[2]_P	3	OPT[1]_P	1	Ref. Voltage
6	OPT[2]_N	4	OPT[1]_N	2	Ref. Ground

Table 24. *Pin assignment of binary I/O connector 1*



5	BIN5	3	BIN3	1	BIN1
6	BIN6	4	BIN4	2	BIN2

Table 25. *Pin assignment of binary I/O connector 2*



5	Binary input 7	3	IBIS_RX_P	1	IBIS_TX_P
6	ODO_IN	4	IBIS_RX_N	2	IBIS_TX_N

Table 26. *Signal mnemonics of spring cage terminal block*

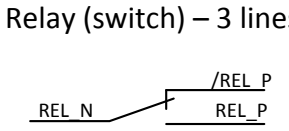
Signal	Direction	Description
/ REL1/2_P	out	NC (normally closed) contact
REL1/2_P	out	NO (normally open) contact
REL1/2_N	-	Common contact
Reference Ground	-	Reference ground for binary inputs
Reference Voltage	-	Reference voltage for binary inputs
OPT[1/2]_N/P	out	Photocoupler lines
BIN[1..7]	in	Binary input lines 1 to 7
IBIS_TX_N/P	out	Differential pair of IBIS transmit lines
IBIS_RX_N/P	in	Differential pair of IBIS receive lines
ODO_IN	in	Odometer input line

3.13.1 Relay Outputs

The BL70W supports two relay outputs with two-way contacts for switching with the following characteristics:

- Max. switching current 0..30 V: 2 A
- Max. switching current 30..72 V: 0.9 A
- Max. switching current 72..154 V: 0.3 A
- Max. switching voltage: 154 V
- Max. switching frequency: 1 Hz
- Minimum life time @ 1A, 30V, 20 cpm: 100.000

Figure 19. *Relay switch - 3 lines (default state)*



3.13.2 Binary Inputs

The BL70W supports seven isolated digital inputs. These inputs work with an input voltage range from 0 V up to 154 V. This input voltage range is independent of the power supply input voltage. The BL70W works with a maximum input signal frequency of 10 Hz.

The input's switching level is 40% (±5%) of the reference voltage. The required input current for high is > 5mA. The required input current for low is < 1mA.

3.13.3 IBIS

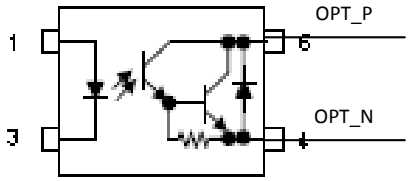
The BL70W provides one isolated IBIS slave interface. The IBIS (Integrated Board Information System) interface is a serial interface which has been established as a standard in the transportation sector for the controlling of display modules. It supports a baud rate of up to 19.2 kbaud.

3.13.4 Photocouplers

The BL70W provides 2 photocouplers used as shutters (see Figure 20, Photocouplers (shutters) - 2 lines). The shutters are open by default.

- Max switching voltage: 154 V
- Max. current: 120 mA (switching and continuous)

Figure 20. *Photocouplers (shutters) - 2 lines*



3.13.5 Odometer Input

The BL70W provides one isolated odometer input for GNSS. This input counts odometer pulses of a maximum frequency of 2 kHz. The value of the counter is read by an IP core (16Z082_IMPULSE) in the FPGA inside the BL70W.

A driver for the IP core is provided on MEN's website

The BL70W supports input voltage levels of up to 154 V.

Table 27. *Odometer switching voltage levels*

PD1 (75k) EN/DIS	PD2 (150k) EN/DIS	High Level	Low Level
DIS	DIS	4.2 V	1.5 V
DIS	EN	8.4 V	3.0 V
EN	DIS	12.6 V	4.5 V
EN	EN	16.8 V	6 V

The odometer default state does not change between power off and power on state. After a power cycle the odometer input enters its default state and will not remember its last value.

A reset does not change the state of the odometer input. During and after a reset the odometer input will hold its state.

Table 28. *Odometer default / reset states*

	PD1 (75k) EN/DIS	PD2 (150k) EN/DIS	PU EN/DIS	Sink 5mA EN/DIS
During Reset	Last value	Last value	Last value	Last value
After Reset	Last value	Last value	Last value	Last value
During power cycle	DIS	DIS	DIS	EN
After power cycle	DIS	DIS	DIS	EN

3.14 GNSS

The BL70W is equipped with the Telit Jupiter SL869 GNSS receiver module with 32 channels. The module supports GPS, Glonass and Galileo.

The GNSS signals are received via a U.FL antenna connector which has to be connected to an external antenna.

The BL70W itself has no antenna. You need to select and connect an antenna suitable for your application. The accuracy is mainly dependent on antenna quality.

Please note that MEN does not supply antennas with the BL70W, since the choice of a suitable antenna depends on your application. The BL70W supports active and passive antennas. An antenna supply voltage of 5V is provided.

The GNSS receiver converts the data received from the antenna to data packets. The time mark signal is readable by application software. The data transfer rate is configurable.

The GNSS's power supply can be reset via GPIO. See Chapter 4.1 SMBus Overview.

As an option, the BL70W's GNSS supports dead reckoning. The box PC is equipped with a 3-axis gyrosensor and provides the possibility to connect an odometer to the GNSS module (see Chapter 4 Controlling the System via SMBus on page 65).

3.14.1 Updating the GNSS Module’s Firmware

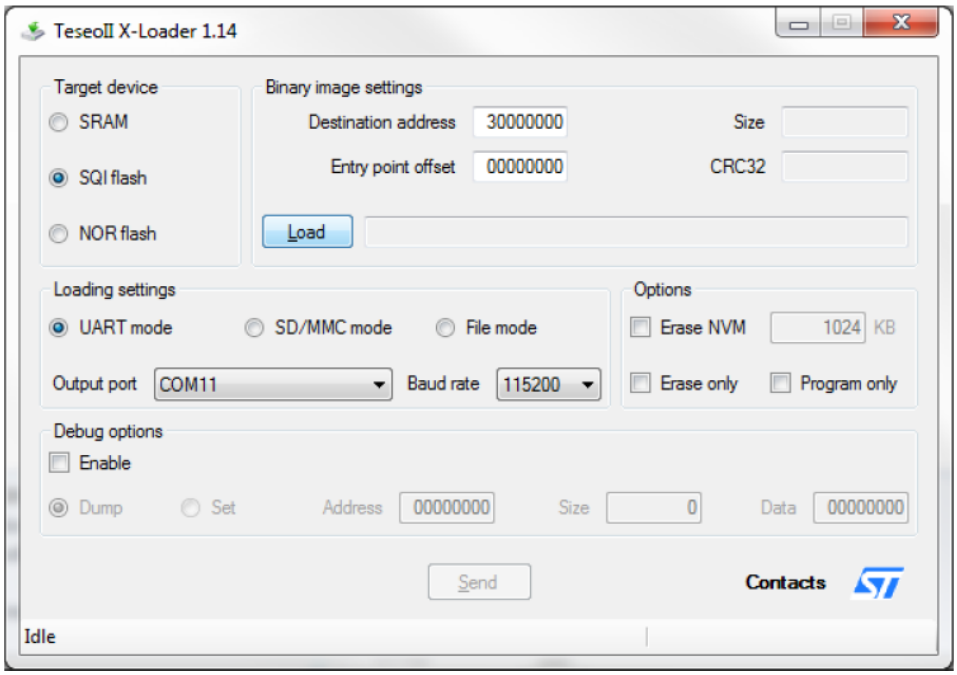
It is possible to update the GNSS receiver firmware. For this, the GNSS sensor voltage has to be switched off and the programming mode be enabled. This can be done using two control signals which can be accessed via the SMBus and an I/O expander. See Chapter 4.1 SMBus Overview on page 65 for more information.

> Please contact the MEN sales team for further information.

Carry out the following steps to update the GNSS module's firmware;

- ☑ Remove all power to the module by setting the GPS_PWR_EN bit to '0'.
- ☑ Enter the programming mode by setting #GPS_FLASH to '0'.
- ☑ Apply the power by setting the GPS_PWR_EN bit to '1'.
- ☑ Launch the (Telit) TESEOII X-Loader and set the selections as shown in the following figure.

Figure 21. *TESEOII X-Loader settings*



- ☑ Click on the Load button then locate and select the provided software by Telit.
- ☑ After selecting the correct Output port for the connected receiver (Look under Device Manager for possible COM connection), click on Send to program the device.
- ☑ Upon successful completion of re-flashing, remove main power to the module for a minimum of 10 seconds by setting the GPS_PWR_EN bit to '0'.
- ☑ Leave the programming mode by setting the #GPS_FLASH bit to '1'.
- ☑ Apply the power by setting the GPS_PWR_EN bit to '1'.
- ☑ Verify that the SL869 has returned to the normal operating state.

See Chapter 7.1.1 GNSS on page 77 for detailed information on the GNSS module.

4 Controlling the System via SMBus

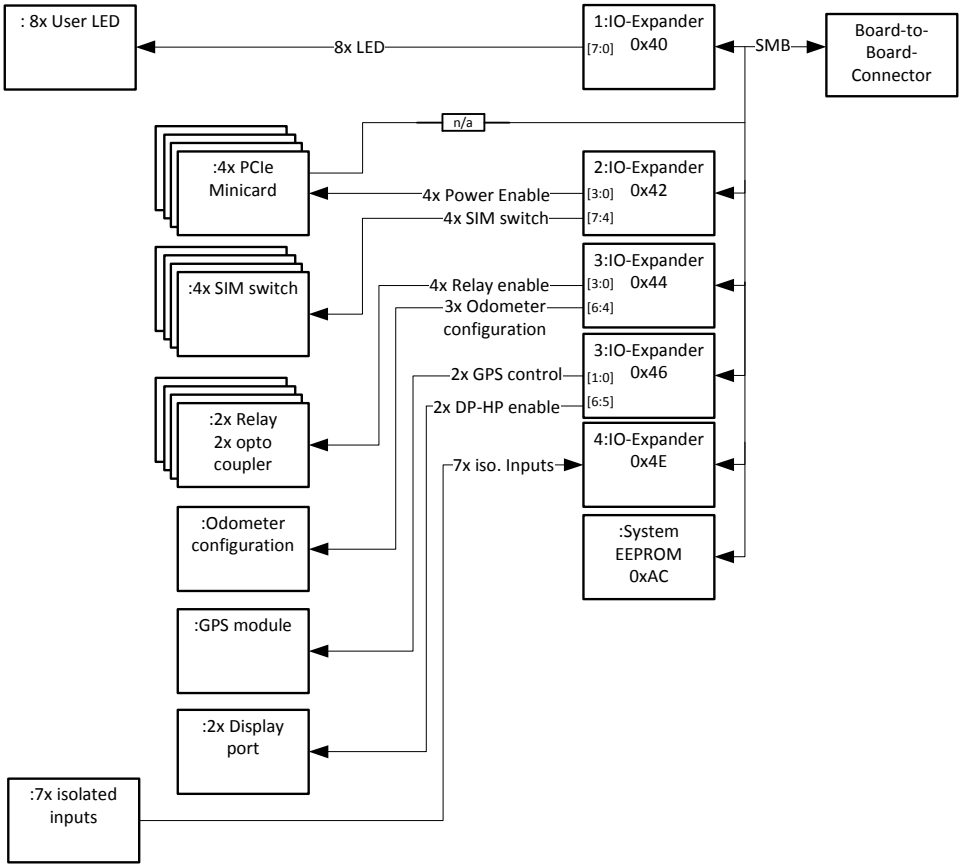
4.1 SMBus Overview

The PCI Express Mini Cards, the microSIM cards, the relays, the photocouplers, the odometer, the GNSS module and the binary inputs can all be controlled using the SMBus and five I/O expanders.

MEN offers a driver for accessing the SMBus. See MEN's website.

Five I/O expanders and a system EEPROM are connected to the SMBus.

Figure 22. *SMBus overview*



4.2 SMBus Register Description

The SMB address is compliant to the Windows nomenclature. This means that the last bit which is used as the read/write bit is added with the value '0' to the address.

Under Linux a 0 is added at the beginning of the address so that all consecutive address bits are moved one bit to the right.

Example

Binary address of the I/O-Expander with hard coded offset 0b 0100 and chosen address bits:

- 0b 0100 (A2)(A1)(A0)(R/W)

With address bits:

- 0b 0100 010 (R/W)

Windows address:

- (R/W) = 0 -> 0b 0100 0100 -> 0x44

Linux address:

- 0b 0010 0010 -> 0x22

Table 29. *SMB address space*

Address	Function
0xAC	EEPROM, includes system information e.g. serial number and the date of production.
0x4E	I/O Expander, used to read back the isolated inputs
0x46	I/O Expander, used to control the GNSS module and ignition status.
0x44	I/O Expander, used to control the odometer interface and the relay outputs
0x42	I/O Expander, used to power cycle the PCIe Mini Cards and to switch between the connected SIM cards.
0x40	I/O Expander, used to control the user LEDs at the front panel.

Binary Input Register (0x4E)

Table 30. *SMB 0x4E*

Bit	Direction	Signal	Default Value	Description	Group
7	In	BIN_IN[7]	-	Value of the connected isolated input	Isolated input
6	In	BIN_IN[6]	-	Value of the connected isolated input	Isolated input
5	In	BIN_IN[5]	-	Value of the connected isolated input	Isolated input
4	In	BIN_IN[4]	-	Value of the connected isolated input	Isolated input
3	In	BIN_IN[3]	-	Value of the connected isolated input	Isolated input
2	In	BIN_IN[2]	-	Value of the connected isolated input	Isolated input
1	In	BIN_IN[1]	-	Value of the connected isolated input	Isolated input
0	In	WDOG_EN	1	Signal to reset the watchdog 0 = Setting this bit to '0' generates a falling edge. The falling edge results in a reset of the watchdog. 1 = For every watchdog reset the bit must be set in sequence '1' -> '0' to generate a falling edge.	System

GNSS Module Register (0x46)

Table 31. *SMB 0x46*

Bit	Direction	Signal	Default value	Description	Group
7	In	IGNITION_ISO	-	Bit to read back the ignition status.. 0 = Setting this bit to '0' results in the same behavior as deactivating the external ignition signal (power button event, starting the watchdog timer) 1 = If the bit is '1' the ignition signal is active.	System
6	Out	DPB_HP_EN	1	Bit to enable the optional pull up at the Display Port hot plug signal. No changes should be made here.	DisplayPort
5	Out	DP1_HP_EN	1	Bit to enable the optional pull up at the Display Port hot plug signal. No changes should be made here.	DisplayPort
4			1	Not used	
3			1	Not used	
2			1	Not used	
1	Out	#GPS_FLASH	1	Controls the operation mode of the GPS module. 0 = By setting the bit to '0' the GPS module is entering the firmware flash mode. 1 = The default value is '1' and the GPS module is in normal operation mode.	GPS
0	Out	GPS_PWR_EN	1	Signal to control the GPS module power supply. 0 = By setting the bit to '0' the power supply of the GPS module is switched off. 1 = The default value is '1' and the GPS module is powered.	GPS

Odometer, Photocoupler, Relay Signals (0x44)

Table 32. *SMB 0x44*

Bit	Direction	Signal	Default Value	Description	Group
7	-	-	1	Not used	-
6	Out	ODO_PU_EN	1	Enable signal for the optional pull up of the odometer interface. 0 = By setting the bit to '0' the corresponding pull up/down resistor is activated at the odometer interface. 1 = The default value is '1' and the pull up/down is not active.	Odometer
5	Out	ODO_PD150K_EN	1	Enable signal for the optional 150k pull down of the odometer interface. 0 = By setting the bit to '0' the corresponding pull up/down resistor is activated at the odometer interface. 1 = The default value is '1' and the pull up/down is not active.	Odometer
4	Out	ODO_PD75K_EN	1	Enable signal for the optional 75k pull down of the odometer interface. 0 = By setting the bit to '0' the corresponding pull up/down resistor is activated at the odometer interface. 1 = The default value is '1' and the pull up/down is not active.	Odometer
3	Out	OPT_EN[2]	1	Enable signal for the second (2) output photocoupler. 0 = By setting the bit to '0' the corresponding coupler is closed. 1 = The default value is '1' and the corresponding coupler is open.	Coupler output
2	Out	OPT_EN[1]	1	Enable signal for the first (1) output photocoupler. 0 = By setting the bit to '0' the corresponding coupler is closed. 1 = The default value is '1' and the corresponding coupler is open.	Coupler output
1	Out	REL_EN[2]	1	Enable signal of the second (2) relay, the relay is used as a switcher.	Relay output

Bit	Direction	Signal	Default Value	Description	Group
				0 = By setting the bit to '0' the corresponding relay is closed or switched (State REL_P). 1 = The default value is '1' and the corresponding relay is open/ not switched (State /REL_P).	
0	Out	REL_EN[1]	1	Enable signal of the first (1) relay, the relay is used as a switcher. 0 = By setting the bit to '0' the corresponding relay is closed or switched (State REL_P). 1 = The default value is '1' and the corresponding relay is open/ not switched (State /REL_P).	Relay output

SIM Card, PCIe Mini Card Power Signals (0x42)

Table 33. *SMB 0x42*

Bit	Direction	Signal	Default Value	Description	Group
7	Out	SIMA_SW	1	Signal to switch between the primary and secondary SIM card of the PCIe Mini Card A. 0 = The secondary SIM card is connected to the PCIe Mini Card 1 = The primary SIM card is connected to the PCIe Mini Card (default value).	PCIe Mini Card
6	Out	SIMB_SW	1	Signal to switch between the primary and secondary SIM card of the PCIe Mini Card B. 0 = The secondary SIM card is connected to the PCIe Mini Card 1 = The primary SIM card is connected to the PCIe Mini Card (default value).	PCIe Mini Card
5	Out	SIMC_SW	1	Signal to switch between the primary and secondary SIM card of the PCIe Mini Card C. 0 = The secondary SIM card is connected to the PCIe Mini Card 1 = The primary SIM card is connected to the PCIe Mini Card (default value).	PCIe Mini Card
4	Out	SIMD_SW	1	Signal to switch between the primary and secondary SIM card of the PCIe Mini Card D. 0 = The secondary SIM card is connected to the PCIe Mini Card 1 = The primary SIM card is connected to the PCIe Mini Card (default value).	PCIe Mini Card
3	Out	MINI_A_PWR_EN	1	The bit is used to control the PCIe Mini Card A's power. 0 = The power of the PCIe Mini Card is disabled. 1 = The power of the PCIe Mini Card is enabled (default value).	PCIe Mini Card
2	Out	MINI_B_PWR_EN	1	The bit is used to control the PCIe Mini Card B's power. 0 = The power of the PCIe Mini Card is disabled.	PCIe Mini Card

Bit	Direction	Signal	Default Value	Description	Group
				1 = The power of the PCIe Mini Card is enabled (default value).	
1	Out	MINI_C_ PWR_EN	1	The bit is used to control the PCIe Mini Card C's power. 0 = The power of the PCIe Mini Card is disabled. 1 = The power of the PCIe Mini Card is enabled (default value).	PCIe Mini Card
0	Out	MINI_D_ PWR_EN	1	The bit is used to control the PCIe Mini Card D's power. 0 = The power of the PCIe Mini Card is disabled. 1 = The power of the PCIe Mini Card is enabled (default value).	PCIe Mini Card

User LED Signals (0x40)

Table 34. *SMB 0x40*

Bit	Direction	Signal	Default Value	Description	Group
7	Out	USR_ LED[10]	1	Enable bit for the corresponding user LED. 0 = The LED is enabled/on. 1 = The LED is disabled/off (default value).	USR_ LED
6	Out	USR_ LED[9]	1	Enable bit for the corresponding user LED. 0 = The LED is enabled/on. 1 = The LED is disabled/off (default value).	USR_ LED
5	Out	USR_ LED[8]	1	Enable bit for the corresponding user LED. 0 = The LED is enabled/on. 1 = The LED is disabled/off (default value).	USR_ LED
4	Out	USR_ LED[7]	1	Enable bit for the corresponding user LED. 0 = The LED is enabled/on. 1 = The LED is disabled/off (default value).	USR_ LED
3	Out	USR_ LED[6]	1	Enable bit for the corresponding user LED.	USR_ LED

Bit	Direction	Signal	Default Value	Description	Group
				0 = The LED is enabled/on. 1 = The LED is disabled/off (default value).	
2	Out	USR_ LED[5]	1	Enable bit for the corresponding user LED. 0 = The LED is enabled/on. 1 = The LED is disabled/off (default value).	USR_ LED
1	Out	USR_ LED[4]	1	Enable bit for the corresponding user LED. 0 = The LED is enabled/on. 1 = The LED is disabled/off (default value).	USR_ LED
0	Out	USR_ LED[3]	1	Enable bit for the corresponding user LED. 0 = The LED is enabled/on. 1 = The LED is disabled/off (default value).	USR_ LED

5 Using the BL70W with MDIS5 Software

This chapter gives specific information on how to use the BL70W with the MDIS5 software.

For details about installation and usage of MDIS5 please refer to the respective MDIS5 user manual. See MEN's website for detailed information and documentation of MDIS5.

The UART, CAN and GPIO interfaces of the Box PC are controlled using IP cores in an FPGA. See the following Figure 35, Chameleon table for a list of the IP cores.

Table 35. *Chameleon table*

Name	Device	Variant	Revision	Interrupt	Group	Instance	BAR	Offset	Size
16Z125_UART	125	0	11	6	0	4	0	220	8
16Z125_UART	125	0	11	4	0	0	0	3F8	8
16Z125_UART	125	0	11	3	0	1	0	2F8	8
16Z125_UART	125	0	11	7	0	2	0	3E8	8
16Z125_UART	125	0	11	5	0	3	0	2E8	8
16Z082_IMPULSE	82	0	2	3F	0	0	1	800	20
16Z034_GPIO	34	0	A	B	0	0	1	E200	20
16Z034_GPIO	34	0	A	B	0	1	1	E240	20
16Z037_GPIO	37	1	1	B	0	0	1	E260	20
16Z126_FLASH	126	0	6	3F	0	0	1	E280	20
16Z029_CAN	29	1	12	B	0	0	1	E400	100
16Z076_QSPI	76	0	7	B	0	0	1	E800	800
16Z029_CAN	29	1	12	B	0	1	1	F000	100

5.1 GPIO Controller Instance 1

The GPIO controller instance 1 is used to switch serial interfaces of the box PCs from UART to CAN or SGPIO. The functions are switched via multiplexers.

The default device name of the instance 1 of the GPIO controller 16z034- is "gpio_2" for Linux and "z17_2" for Windows.

Table 36. *Functions of GPIO controller instance 1*

Bit Position	Output-Function (GPO)	Input-Function (PSR)	Default Setting
5	mux_if2	-	GPO(5):drive 0
6	mux_if0	-	GPO(6):drive 0
7	mux_if1	-	GPO(7):drive 0

Interface Multiplexer (mux_if0)

The interface multiplexer 0 is used to change the serial interface 5 (X12) from UART (default setting) to SGPIO (required if you want to use the SA15 SA-Adapter in this slot).

Table 37. *Interface Multiplexer 0 truth table:*

Interface	Function	mux_if0
SA0	UART0	0
	SGPIO	1

The interface is switched using the following commands:

For Windows:

```
z17_io z17_2 -p=6 -s=1 -h
```

For Linux:

```
z17_io gpio_2 -p=6 -s=1 -h
```

Interface Multiplexer (mux_if1)

The interface multiplexer 1 is used to activate serial interface 3 (X10).

Table 38. *Interface Multiplexer 1 truth table*

Interface	Function	mux_if1
GPIO[7:1]	No functionality	0
	Serial Interface 3 (X10) is active	1

The interface is activated using the following commands:

For Windows:

```
z17_io z17_2 -p=7 -s=1 -h
```

For Linux:

```
z17_io gpio_2 -p=7 -s=1 -h
```

6 Maintenance

6.1 Cleaning the System

The system should be cleaned once a year. Clean the bottom and top plate, remove dirt and dust from air ventilation holes. Light dirt can be removed with a dry cloth. Persistent dirt should only be removed with a mild detergent and a soft cloth.

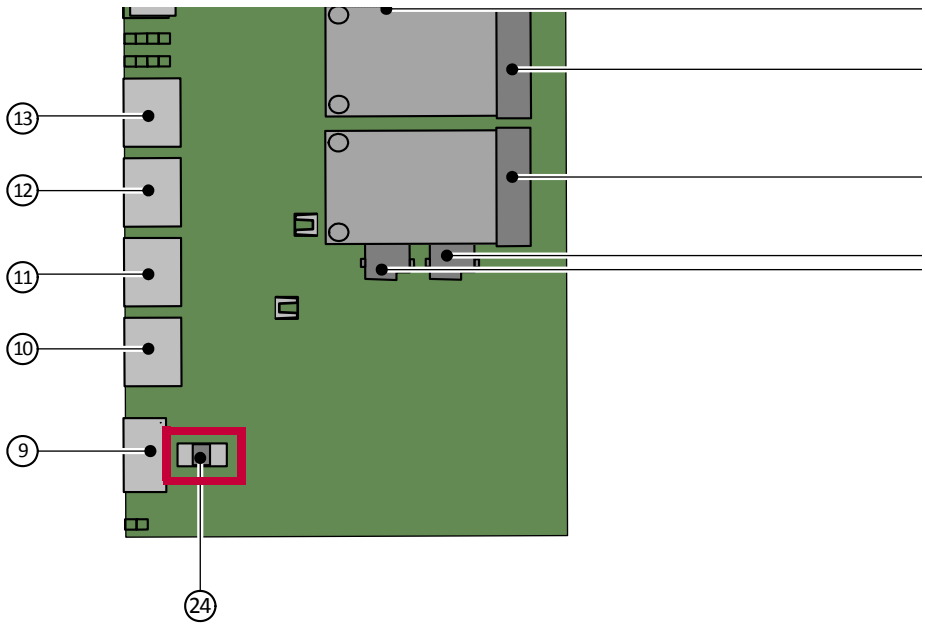
Take care that no liquid gets inside the system.

6.2 Fuse Protection

The DC/DC converter inside the Power Supply Unit is protected by a fuse. **This fuse is not intended to be exchanged by the customer. Your warranty for the Power Supply Unit will cease if you exchange the fuse on your own.** Please send your unit to MEN for repair if a fuse blows.

- Current rating: 5 A
- Voltage rating: 350 VDC
- Type: Time-Lag (T)
- MEN part number: 5675-0011

Figure 23. *Position of the fuse in the interior of the BL70W (highlighted in red)*



7 Appendix

7.1 Literature and Web Resources

BL70W data sheet with up-to-date information and documentation:
www.men.de/products/09BL70W.htm

7.1.1 GNSS

Jupiter SL869 EVK GNSS module
Jupiter SL869 EVK User Guide

7.1.2 Accelerometer / Magnetometer LSM303DLM

Manufacturer's product page for LSM303DLM
STMicroelectronics
http://www.st.com/web/en/catalog/sense_power/FM89/SC1449

7.1.3 CAN Bus

CAN in Automation e. V.
www.can-cia.de

7.1.4 DVI

Digital Visual Interface Revision 1.0
www.ddwg.org

7.1.5 Ethernet

- ANSI/IEEE 802.3-1996, Information Technology - Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications; 1996; IEEE
  www.ieee.org
- Charles Spurgeon's Ethernet Web Site
  Extensive information about Ethernet (IEEE 802.3) local area network (LAN) technology.
  www.ethermanage.com/ethernet/
- InterOperability Laboratory, University of New Hampshire
  This page covers general Ethernet technology.
  www.iol.unh.edu/services/testing/ethernet/training/

7.1.6 HD Audio

Intel High Definition Audio:
www.intel.com/design/chipsets/hdaudio.htm

7.1.7 PCI Express Mini Card

PCI Express Mini Card Electromechanical Specification
Revision 1.2; October 26, 2007
PCI Special Interest Group
www.pcisig.com

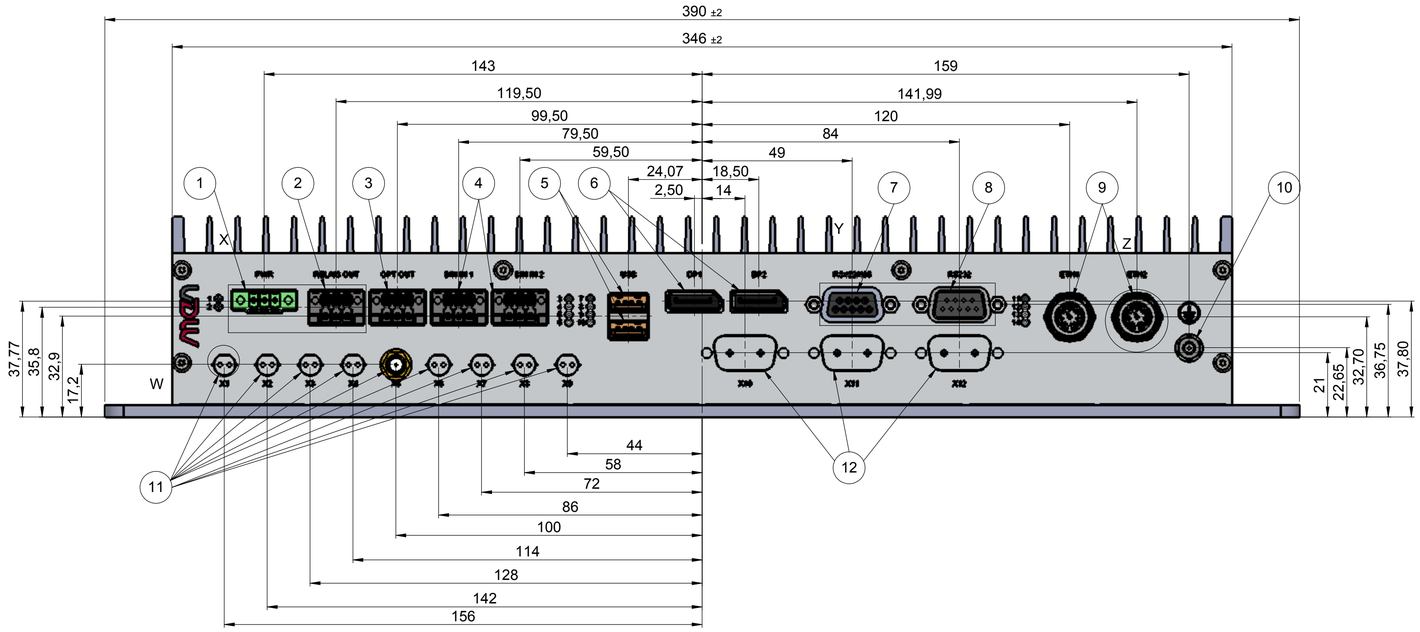
7.1.8 USB

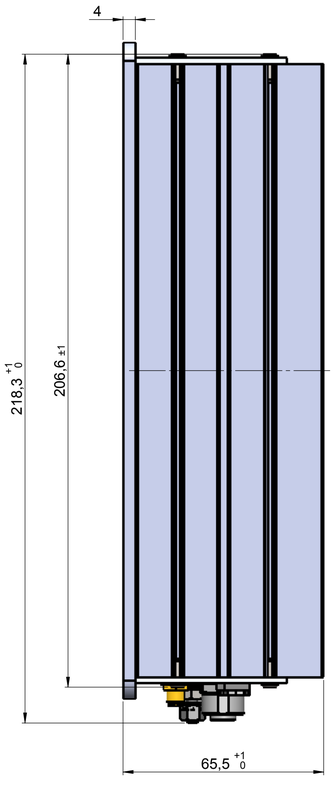
USB Implementers Forum, Inc.
www.usb.org

7.2 Dimensions of the BL70W Box PC

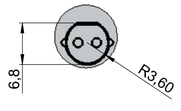
In the following you can find a drawing of the exact dimensions of the box PC.

Position	Quantity	Function	Description	Mating connector
1	1	Power	Mini Combicon Plug Grid 3,5mm	Mini Cobicon Jack e.g. Phoenix: 1966101
2	1	Relais output	Dual Mini Combicon Plug	Dual Mini Combicon Jack e.g. Phoenix: 1790496
3	1	Optical output	Dual Mini Combicon Plug	Dual Mini Combicon Jack e.g. Phoenix: 1790496
4	1	Binary input	Dual Mini Combicon Plug	Dual Mini Combicon Jack e.g. Phoenix: 1790496
5	2	USB	USB Type A Jack	USB Type A Plug
6	2	Display	Display Port Jack	Display Port Plug e.g. Molex: 0687830001
7	1	RS422/485	DSub female 9-pin	Dsub male 9-pin
8	1	RS232	DSub male 9-pin	DSub female 9-pin
9	2	Ethernet	M12 Jack 8-pin A-coded	M12 Plug 8-pin e.g. Conec: SAL-12RS8-2/A1
10	1	Ground	M4 Bolt	Cable eye
11	9	Antenna	Pending on function	Pending on function
12	3	SA-Adapter	Pending on function	Pending on function

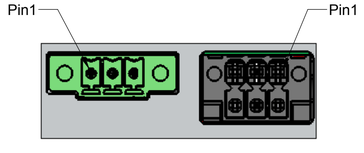




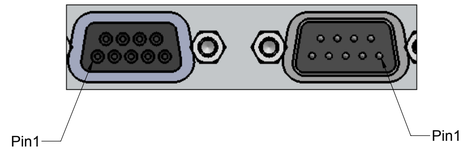
W (2 : 1)



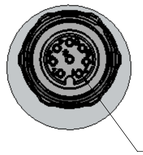
X (2 : 1)



Y (2 : 1)



Z (2 : 1)



Manufacturer number: 09BL70W00
Weight: max. 3,2 kg
Input voltage: 24VDC (nom.)
Operating temperature: -40°C ... +70°C

1.0	sdietz 2014-11-11	Initial version	
Rev.:	Prepared/Date:	Modification:	
Responsible author: S.Dietz			RoHS-compliant (2011/65/EU): yes
Printed versions FOR INFORMATION ONLY. This is an electronic document. It has been digitally signed. Please see release form.			For this document all rights are reserved.
Scale: 1:2		Tolerance: --- ---	DIN ISO 13715
Material: --- ---		Surface: Transparent passivated (electrically conductiv)	
Description: Space allocation drawing 09BL70W00_SAD (1.0)		Document No. 09BL70W00_SAD	DIN A1
			Prj.: 1422 Sheet: 1 / 1

MEN_TB_SW_Rev_1.0